Electrical Review

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Electrical Review

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THE OPPORTUNITY.

The student of social and political affairs can not fail to see in the present conditions which surround the greater part of the world a marvelous opportunity for American commerce which will not likely be repeated.

Great Britain, our closest friend and bitterest trade rival, is engaged in a war which has withdrawn from its territory a large number of men comprising a highly active industrial element. It is also in the throes of an industrial revolution, having wakened to the fact that its methods of manufacture must soon be reorganized unless its prestige as an export country is to disappear. France, though rent by political strife, is to hold this year its great exposition and to put forward its best efforts to retain some of the manufacturing industry which is slipping away from it. The German Empire is making herculean efforts to gather for itself the fruits of the situation, but it is hampered beyond ordinary understanding by the existence of its military system, and also in great measure by the hostility of other countries toward it. The Italian peninsula is waking from a sleep of centuries under its present stable and popular government and is welcoming the importation of new ideas, new methods and new machinery for the development of its natural riches. Russia can not be a manufacturing country for many decades, but its enormous population and vast extent present a great market for all manners of goods. In the East the acquisition of the Philippine Islands has focused the attention of the world upon that region, while the policy of England and the United States in China is such as to invite at once the widest extension of trade.

Hence, the time has come for American manufacturers to take the same position as a factor in the world's supply that has been held by their agricultural brethren for many years. This country is blessed with an enormous and increasing prosperity. It is at peace and likely to remain at peace with all its neighbors. It has every advantage of climate, resource and skillful population to put it in the first rank of manufacturing countries and keep it there. The rest of the world is its market. These few facts are things that no American maker of any goods that are used by any people on the face of the earth should ever forget.

MUNICIPAL OWNERSHIP.

The article by Mr. Allen Ripley Foote, on other pages of this issue, contains much food for serious thought for those who are interested in the ever present question of the municipal ownership of public franchises. The distinction drawn by Mr. Foote between social service and industrial service as performed by corporations or others supplying public service utilities is an interesting one. It contains the gist of the matter and is the logical basis upon which argument pro and con concerning municipal ownership should be based.

The whole matter seems, in a way, too simple for elaborate discussion. The municipality has no right to tax its citizens save for their own benefit. It is conceded by all people that the maintenance of such institutions as the necessary courts of justice, the machinery of administration, the protection of life and property by police and fire departments, the maintenance of sanitary conditions, etc., are things which all citizens are directly and vitally interested and for which it is proper that every person living within the scope of the municipal government should be required to pay his proportionate part. This elementary principle of justice can not, however, be made to include those services which

supply only a part of the citizens and not all. For example, the distribution of water, which is a commodity needed by every person as well as by the community at large for protection against fire and sanitary purposes, is fitly within the province of the municipality. The distribution of gas or electricity for lighting is not an essential, except in so far as it relates to lighting streets and public places. If a municipality undertakes to supply the consumers with electric light it enters into one or the other of three things which are easily proved to be inequitable: If the plant is operated at a loss, the taxpayers as a body must make up the deficit for the benefit of the individuals who use light. If it is operated at a profit, the individuals who use light must pay the profit to the relief of the body of taxpayers who would otherwise be called upon to provide the increased income. If it is run at neither a profit nor a loss, then the municipal government is gratuitously undertaking the burden and responsibility of a business which is not profitable to it and which, by extinguishing the opportunity for competition, deprives its citizens of a certain just and natural right to buy in the cheapest market the commodity that they need.

This, it seems, is the common sense of the municipal ownership situation. It is of interest to observe the change in opinion which is gradually coming over the public in Great Britain, where for years the municipal operation of such public services has obtained. While these have been admirably conducted from the point of view of economical administration and upright and honest management, they have failed to satisfy the public and there is a constantly increasing demand for the chartering of private concerns to engage in the same lines of work. In other words, even in the oldest and most conservative community in which municipal ownership has had a fair trial it has proved itself a failure. It seems strange, therefore, that such a thing should be advocated in this country and doubtless the reason for its warm championship is often to be found in political aspirations on the part of self-seeking members of municipal governments.

CONCERNING EXPOSITIONS.

The Exposition fever in its virulent and acute form may be said to have broken out at the time of the Centennial twenty-four years ago. The great show at the Crystal Palace, in London, half a century ago, was the first of its kind and was a wonderful success. The French, quick to seize the idea of a national *fete,* began their series of expositions about the time of our celebration of the hundredth birthday of the United States, and in 1889 held a sumptious fair in Paris, resulting in much profit to themselves, and, incidentally, considerable extension of trade to exhibitors.

Close upon this successful exposition, others were inaugurated, many of them on too small a scale to command universal attention. The series culminated in the superb World'sFair, at Chicago, in 1893—certainly the finest and greatest exposition that has ever been held.

The Paris Exposition of this year, intended by its projectors to mark the triumphs of the closing century, has unfortunately fallen at a time when one powerful nation is at war, and when the whole European political situation is such as to cause alarm to the friends of peace. Animosities that have been long smoldering are being fanned into a blaze, and the time is singularly bad for such an enterprise as an international show.

It does not appear likely, therefore, that the Paris Exposition of this year will exceed the Chicago fair in point of magnitude or interest. It will be, of course, very beautiful and probably well-managed, but it is doubtful whether the American exhibitors who participate in it will be rewarded by large profits. To put it plainly, people are tired of expositions, and the expositions themselves have shown a tendency of late years to degenerate and to allow the "side show" element too much prominence.

This somewhat pessimistic view of the situation seems to be justified by the facts, however. It is thought that the exhibits of British and American goods will not be very large or complete and that the Exposition will be more local in its scope than it has been in former years.

The Automobile Show.

The plans for the first Automobile Show have now taken definite shape. To letters sent out to a number of manufacturers, making inquiry as to the most desirable time to hold such a show, responses were received, all expressing a preference for the Fall season, and offering their heartiest cooperation towards making it a complete and representative exposition.

The dates selected are from Saturday, November 10 to Saturday, November 24, inclusive, and ample time will be allowed for installing and removing exhibits. It is considered an advantage that the Horse Show will be held during one of these weeks—from November 19 to 24. There are each year something more than 50,000 out-of-town visitors to the Horse Show, and practically the same people will be interested in automobiles. The dates chosen for the Automobile Show will therefore make it practically certain that the attendance and visitors to the Horse Show will also be secured for the Automobile Show.

Grand Central Palace, covering a city block from Forty-third to Forty-fourth street, and Lexington avenue to Depew place, has been chosen for the exposition. It has a large exposition space and will permit a most comprehensive show. One hundred thousand square feet of floor space are available for automobile exhibits.

The centre space of this exposition hall is an amphitheatre, with glass roof 65 feet high, containing more than 10,000 square feet of floor space. This will be for the free use of exhibitors who may wish to show their automobiles in motion. Besides the wide aisles surrounding this amphitheatre, and leading to it, there are two large balconies from which these demonstrations will be clearly visible—accommodating 3,000 spectators—and the floors are strong enough in every part to support the weight, no matter how distributed, so that platforms in the various exhibits will be unnecessary—a saving and a convenience.

The location of the Grand Central Palace is also an advantage. It is in the centre of the city's street car transfer system, and in the heart of the residential, and therefore the automobile district. Something of the capacity of the building for an automobile show may be gathered from the recent Carriage and Wagon Exhibition, where more than 1,100 finished vehicles were shown, and more than 20,000 square feet of floor space occupied by exhibitors of accessories.

The exposition will be under the management of Mr. Marcus Nathan, who managed the three Electrical Shows held in New York city, and is now arranging a printing exposition for the month of May.

Contract for New York Rapid Transit Tunnel Signed.

The $35,000,000 contract between the Rapid Transit Commission and Mr. John B. McDonald, the contractor who is to build the tunnel road, was signed on February 24, Mr. McDonald leaving in the hands of the Comptroller a certified check for $1,000,000, securities to the amount of another million, and bonds executed on the contractor's behalf for $6,000,000 more.

Work will begin in 30 days. The line has been divided into fifteen sections, extending from the City Hall to the Northern limits of the city, and will be pushed as rapidly as possible to conclusion.

It is rumored that the tunnel road will be operated by the Metropolitan Street Railway Company, but as yet it is not possible definitely to verify this report.

Wall Street and the Electrical Stock Market.

Price movements in the stock market during the past week were limited. The embarrassment of the Third Avenue Railroad Company was a feature of the week, although the opinion was expressed that within a few days arrangements would be completed by which the company's floating debt would be cared for.

On the New York Stock Exchange General Electric closed the week at 126 bid and 128 asked, a gain of ¼ point for the week. Metropolitan Street Railway, of New York, closed at 173¾ bid and 174½ asked, a loss of 3¼ points for the week. Third Avenue Railroad, of New York, closed at 75⅜ bid and 75½ asked, a loss of 21½ points for the week. Brooklyn Rapid Transit closed at 69⅝ bid and 69¾ asked, a loss of 2¾ points for the week. Manhattan Railway, of New York, closed at 95¾ bid and 96¼ asked, a loss of 2⅜ points for the week.

On the Boston exchange, American Bell Telephone closed at no bid price and 330 asked, a loss of 9 points for the week. Erie Telephone closed at 119 bid and 119½ asked, a gain of 9 points in the bid price for the week. It is understood that several New York capitalists are to become interested in the company.

On the Philadelphia exchange, Electric Storage Battery closed at no bid price and 91 asked. Union Traction closed at 37⅜ bid and 37½ asked, a gain of ¼ point for the week. Electric Company of America closed at 13 bid and 13⅛ asked, indicating no change for the week.

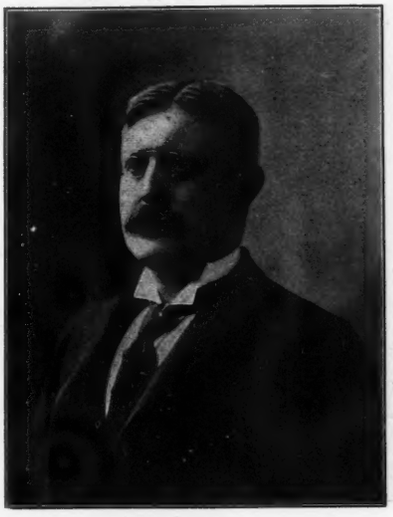
On the curb or outside market in New York, Electric Vehicle closed at 40 bid and 44 asked, showing no change for the week. Electric Boat closed at 16 bid and 18 asked, a loss of 1 point for the week. Electric Axle was not quoted.

Wall Street, February 24.

Mr. Chester D. Crandall.

Mr. C. D. Crandall, manager of the Western Electric Company, Chicago, whose portrait we present on this page, has won an enviable position in the industrial electrical world. The very extensive affairs of the Western Electric Company, of Chicago, are under his direct management and as this is the head office of the company, important matters also have to be handled relating to the big house in New York city and the European branches.

Mr. Crandall is a native of New York and his first work of an electrical nature was in the accounting department of the Western Electric Company, in this city. In 1882 he decided to go west and became secretary and treasurer of the Missouri & Kansas Telephone Company, at Kansas City, Mo. Mr. E. T. Gilliland, the well-known telephone man was president of the company at the time. Mr. Crandall remained in telephone work for a number of years and then at the solicitation of Mr. E. M. Barton, president of the Western Electric Company, returned to his "first love," where his advancement has been pronounced and constant. He is very popular with all his associates and the many thousand employees engaged in the various departments under his management.



MR. CHESTER D. CRANDALL.

Mr. Crandall has extensive interests in the electric lighting and telephone fields, and is an enthusiastic believer in the exploitation of electric power and electric lighting plants using water-power as sources of generation. A large plant recently installed in Mexico is controlled by him. Mr. Crandall recently constructed a beautiful home on the lake front in North Chicago.

A Gigantic Telephone-Telegraph Deal.

It was announced on Tuesday that the Telephone, Telegraph & Cable Company of America and the Western Union Telegraph Company had purchased the extensive system of the Erie Telephone Company, of Lowell, Mass.

It was further reported that as a number of Postal Telegraph men were on the board of the Erie the new deal meant a consolidation of all the four companies against the American Bell Telephone Company. The stock of the latter company declined very materially when the combination was announced.

PERSONAL.

Mr. J. G. White, the well-known electrical engineer, sails for England to-day, where he has extensive engineering projects under way.

Mr. J. M. Hollister, president of the Chicago Electrical Association, will leave for Paris on March 14. Mr. Hollister is the engineer in charge of the preparation for the Western Electric Company's exhibit at the Paris Exposition, and will remain there during the exposition.

A trio of electrical workers, namely W. L. Candee, of New York, and George A. McKinlock and Angus Hibbard, of Chicago, started the first of this week on a visit to the Pacific coast. Mr. John I. Sabin, the telephone magnate of San Francisco is hereby warned, it is to be hoped, in time.

A number of out-of-town electrical men have been visiting New York city during the past week or 10 days. Among these were the following Chicagoits: W. W. Low, Electric Appliance Company; C. E. Brown, Central Electric Company; L. E. Cushing, Illinois Electric Company; St. Louis was represented by A. C. Garrison, of the Columbia Incandescent Lamp Company; R. V. Scudder, Western Electric Supply Company, and F. C. Laufketter, Commercial Electric Supply Company; Cincinnati by Sam Glover, of the Post-Glover Company, and S. L. Lawrence, of the Standard Electric Company; Boston by C. B. Price, Pettengell-Andrews Company, and H. T. Thomson, Electric Gas Lighting Company; Philadelphia by Frank H. Stewart, of Frank H. Stewart & Company, and George W. Vallee, of Vallee Brothers & Company; Pittsburgh by W. H. Doubleday, of Doubleday-Hill Electric Company; Bridgeport, Ct., by W. C. Bryant and E. M. Scribner, of the Bryant Electric Company.

The Akron, Bedford & Cleveland Electric Railway.

Facilities of transportation engender civilization. Steam was the father of industrial progress, but electricity, like a stalwart son, is reaching out and further developing the lines of progress initiated by its sire. The Akron, Bedford & Cleveland Electric Railroad, in the state of Ohio, affords an excellent example of the important benefits which may be derived from an electric railroad, in spite of the fact that the route traversed parallels steam railroads. There is a field for both steam and electric traction.

There are several causes which lead to the success of electric roads: The fares by trolley cars are usually about one-half those charged by steam railroads, and the cheapness develops local traffic; alse there springs up a freight and parcel business as provision is made for handling it. Steam trains are more rapid than trolleys between terminus and terminus, but the time saved by boarding or leaving electric cars at more convenient points brings a great deal of traffic to the road, and indeed creates a good deal of business.

Along the line of the Akron, Bedford & Cleveland Road the value of land has increased rapidly, and in some cases has risen as much as 100 per cent above the price at which it was formerly held. Facilities of transfer have been granted by the city railroads of Cleveland and Akron which enable passengers by the incoming road to be transferred to any part of the cities without further charge.

Cleveland is rich and prosperous, having a population with its suburbs of upwards of 400,000. Essentially a manufacturing place, it has grown up aided by the shipping facilities of the great Lakes, and has a considerable population of wealthy citizens. Akron lies 35 miles almost due south of Cleveland, and is also a city of important manufacturing interests, having a population with its suburbs of almost 50,000. The electric railway between these two points passes through populous villages and towns.

The track of the Akron, Bedford & Cleveland Road is laid upon the highway for a distance of 25 miles; for the remaining 10 miles it is upon the private property of the company, the right of way having an average width of 50 feet, enclosed by wire fencing. The country through which the railroad passes is of an undulating nature, and several cuttings had to be made and valleys filled in to reduce the grades.

On the main line the maximum grade is 6½ per cent, but on the Akron connection there is one grade of 13 per cent, 930 feet long, and another of 8 per cent on a sharp curve. Regular steam railroad construction is used throughout, the outer rail being elevated at all curves and a guard rail laid, that the curves may be safely rounded at 30 miles an hour speed. Side poles with iron pipe brackets are used for the overhead construction, spaced 90 feet apart. There are three feeders, two of 300,000 circular mils, and one of 200,000 circular mils, whose aggregate length is nearly 26 miles. The trolley wire is Browne & Sharpe No. 0000 hard drawn copper. The main line is laid with 60-pound "T" rails, on white oak ties, spaced 18 inches between centres, and ballasted with gravel. The line is double-track throughout.

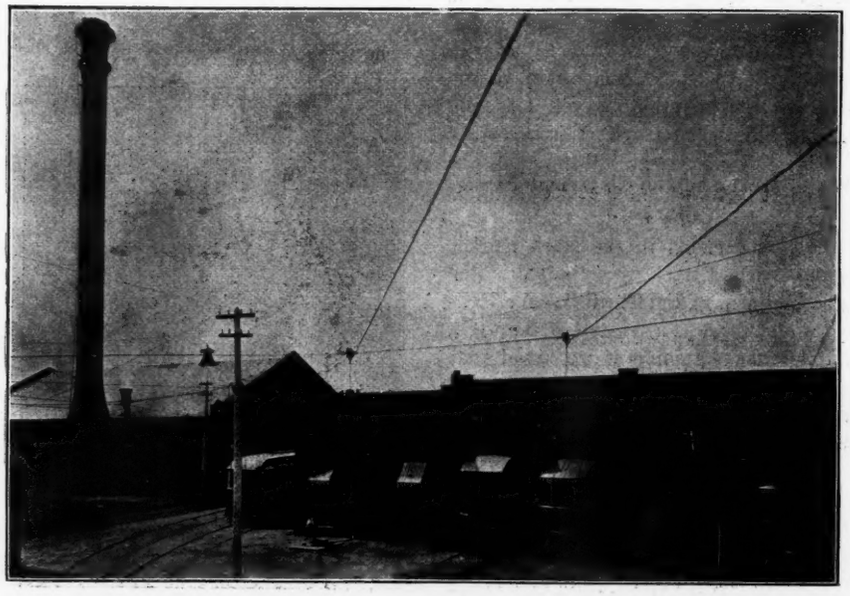


Fig. 2.—The Electric Railway Station at Cuyahoga Falls, Ohio.

The electrical equipment for the Akron, Bedford & Cleveland Railroad was furnished by the Westinghouse Electric and Manufacturing Company. There are two power houses, one at Bedford, on Tinker's Creek, 12 miles from Cleveland, and the other at Cuyahoga Falls. The former supplies current for 12 miles to the north, and nine miles to the south, and the latter nine miles to the north and five and one-half miles to the south of Akron. The two power houses are virtually identical in equipment, a description of the Cuyahoga Falls power house will therefore serve for both. Steam is supplied at 120 pounds pressue by 250-horse-power Stirling boilers, to two simple non-condensing 350-horse-power Allis-Corliss engines, running at 82 revolutions per minute, which are belted to the generators. Fig. 1 gives a view of the interior of the power house showing a generator belted to the engine. The engine flywheels weigh 39,000 pounds each.

The two Westinghouse generators at each station are 250-kilowatt, two-phase machines, with eight poles and distributed winding. The armatures are wound for both alternating and direct current, and have both commutators and alternating-current collector rings, the latter being outside the former. The voltage of the alternating-current side is 380, while that of the direct-current side is 550. The output of the machines, if the alternating-current side were used alone, would be about equal to its direct-current capacity when used alone. Generators of this character were installed for two reasons: At present they supply direct-current for the traction line. In the future it is the purpose of the railroad company to operate the Cuyahoga Falls station by water-power, transmitting current to the Bedford station by the two-phrase system, and thus discard the steam engines in both stations. When the hydraulic system is completed, the generators now installed can be used as rotary converters.

The generators are provided with three bearings, the pulley having an outboard bearing which greatly stiffens the machine. The bearings are self-aligning and self-oiling, being cast in one piece with the frame plate, the caps being put on by four bolts each. The brushes are fitted with screw adjustment, operated by a hand wheel through a pair of bevel gears. The field poles are laminated and rigidly held by a circular frame or yoke of cast-iron. The armature, or revolving element, is of the ironclad type; the core is built up of

thin steel plates of the best magnetic quality. Copper of the highest conductivity is used for the windings. The speed of the generators is 400 revolutions per minute. The machines run in multiple, being connected by an equalizer wire, and the power leads pass to the switchboard.

Six panels constitute the switchboard which follows the usual Westinghouse practice. Two of the panels control the generators, the third is the load panel, and the three remaining are the feeder panels for the circuits. The generator panels are provided with a rheostat for controlling the output of the dynamo, a main double-pole, single-throw switch, a voltmeter switch, a lightning switch, circuit breaker, the moving mechanism being placed at the back of the board, and a round type Weston ammeter. The load panel is provided with a voltmeter, integrating wattmeter, and a ground switch which carries the entire station load. The three feeder panels each carry two circuits, each circuit having a single-pole switch and circuit-breaker. All the panels are provided with pilot lamps. The panels are of white marble, mounted in brass. In the rear of the board are Wurts tank lightning arresters, and choke coils for protecting the apparatus from electrical storms.

Fig. 2 gives a view of the exterior of the building at Cuyahoga Falls. To the right is the car house, adjoining which are the offices of the Akron, Bedford & Cleveland Railroad Company. The main track passes between the company's offices and the power station seen to the left of the illustration. All the buildings are of brick, with steel truss roofs.

The cars of the Akron, Bedford & Cleveland Railroad Company are very similar to those in use on steam railways. They are 41 feet long, over all, mounted on two trucks, equipped with four Westinghouse No. 38 50-horse-power motors and electric brakes. The cars are designed to run in one direction only, the front platform being protected by a permanent vestibule. The car have seating accommodation for 42 passengers, each car being provided with cross seats upholstered in plush, with a centre aisle; they are also equipped with toilet, ice-water tank, and 20 electric lights. On the side of every seat is a push-button for communicating with the conductor. Electric heaters are placed at the side of the cars, one of them in the motorman's compartment. About one-half of the motor cars are built with a baggage compartment, which reduces the passenger accommodation to 32 seats. In order to secure greater adhesion when the car is heavily loaded, and also provide a pilot truck for the car, two motors are mounted on each truck, which enables a speed of 50 miles an hour to be attained.

To remove snow from the track, snow scrapers are attached to every car. The company has in addition two heavy snow plows, equipped with three 50-horse-power motors, one of which is shown in Fig. 3. During the snow storms which have occurred during the late Winter, no trouble was experienced with snow blockades, although there are several deep cuttings on the road.

Such an extensive line involved new problems for despatching and operating the system. To facilitate this work the company has established a special telephone exchange at its Cuyahoga Falls office, and all cars are operated by a regular train despatcher. The office and residences of the operating officials are connected with the exchange by direct wires, and a portable telephone outfit is carried on each car. This outfit enables connection to be made from the despatcher's line with the central office at any of the sidings, and at every 825 meters along the track. No signal bell is required, as the act of cutting into the line gives the signal. The telephone wires are strung on the company's own poles, and to overcome the induction of the railway current, a metallic circuit is used, consisting of a three or four conductor cable with wires intertwisted.

A large pleasure traffic is carried during the Summer months. The line passes Tinker's Creek gorge at Bedford, and also

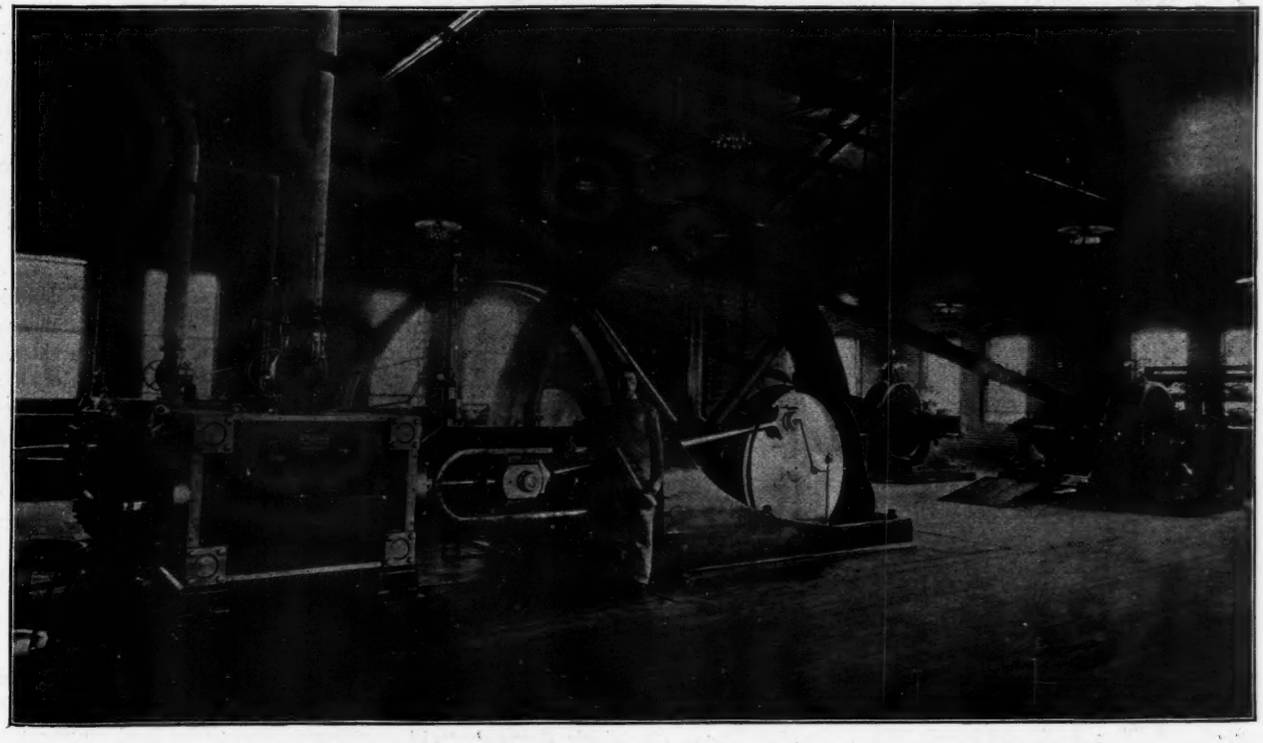


FIG. 1.—INTERIOR OF THE CUYAHOGA FALLS POWER-HOUSE OF THE AKRON, BEDFORD & CLEVELAND ELECTRIC RAILWAY.

four other well-known picnic resorts for Summer parties. Some of these properties are owned by the Traction Company, and all are noted for their wild and picturesque scenery, attracting a great deal of traffic.

The fare charged for the through journey from Akron to Cleveland is 60 cents, and a return ticket is one dollar. For this sum a person can travel from any point on the street railway system in Akron to any point on the line of the Cleveland Electric Railway Company, or *vice versa*. Excursion tickets for theatre parties and Summer excursions are sold at a reduced rate. The steam railroad fare is $1.15 for a single ticket, and $1.90 for a round trip ticket. The electric cars run every half-hour, making the trip in one hour and fifty minutes. Between the city limits the running exceeds 25 miles per hour including stops.

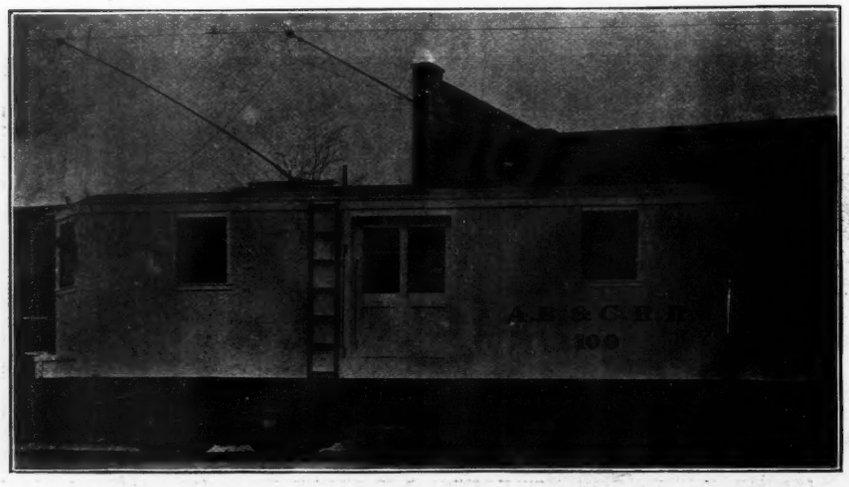


FIG. 3.—ELECTRIC SNOW-PLOW CAR ON THE AKRON, BEDFORD & CLEVELAND R. R.

The successful operation of the Akron, Bedford & Cleveland Electric Railroad has led to extensions east and west from Cleveland to Painesville and Elyria. Electrical service in northern Ohio is receiving great attention. Westinghouse, Church, Kerr & Company, New York, have contracted for a line 62 miles in length, from Toledo to Norwalk, which will be operated in a novel manner. All the power will be supplied from one central power house by means of alternating-current to rotary converters which will deliver the requisite continuous-current. Other extensive lines are also projected. As already pointed out in this article electric railroads open up a new field of traffic and develop new neighborhoods, for with facilities for travel, dwellers in cities become suburban residents. The cost of installation and operating expenses of electric railroads being far less than those of steam railroads, lower fares by electric cars are remunerative.

VIEWS, NEWS AND INTERVIEWS

One of the latest uses of electricity is its application as a headlight in the walking canes of gentlemen, who for one reason or another find themselves out late at night. The new "pathfinder," as the electric cane has been called, does not differ in appearance from the ordinary walking cane. In the head of the "pathfinder," however, is fixed a small but powerful electric light, covered by a shield, which can be instantly lighted by the pressure of a button near the head. Behind the light is a strong reflector, so that the light in action is really a miniature searchlight.

A Kansas City telephone company has decided that all girls in its employ must have long arms, and that their height must be at least five feet, six inches.

"The Belgian plan for electric canal towing," says *Chamber's Journal*, "will have only one generating electric station, which will serve not only to supply the necessary motive power to the traction engine, but will enable electric light to be supplied to any neighboring village or even hamlet at as moderate a price as that enjoyed by large towns. The route taken by the engine is to be about 30 miles, though we may confidently expect that in time the entire service of canal haulage will be worked by this particular motive power. The engine has three wheels, the two back ones being the motive wheels. The front one of this tricycle is the guiding wheel, which is manœuvred from behind by a driver ensconced in a covered shelter, which contains the starting and directing apparatus, the brake and the drag. The traction cable is attached to the framework of the carriage and by means of two trolleys running on wires takes current from the aerial line which, supported on wooden posts, is placed along the canal banks. It is, in fact, practically the same as the overhead system in use for tramways in many large towns. The tow-line is fixed laterally to the framework of the engine."

An amusing anecdote is told in connection with the new electric tramway system just opened on a section of the Aberdeen lines, says a British contemporary. Two farm servants came to Aberdeen to spend New Year's Day. Arriving by train they immediately made their way to the terminus of the electric tramway circuit, where, after looking at the new creation with much wonder, they decided upon having a ride. Getting on to the top of the car, and after getting well along George street, "Wull," said man Jock, "this is a graun' invention. In Edinburgh I saw them drive the cars wi' an iron rape aneth street, in Dundee they pu' them wi' an engine, but, michty man, wha wad a' thocht they could ca' them wi' a fishing-rod!"

At the last meeting of the Huddersfield, England, Chamber of Commerce, in view of the lack of enthusiasm shown by the manufacturers in the district, it was decided to abandon the proposed collective exhibit from Huddersfield. This is, says the London *Electrical Engineer*, quite a natural result of the attitude which the French papers have taken with respect to the war in South Africa, and to the disgraceful cartoons which have but recently appeared in the Parisian press.

The Sao Paulo Railway, Light and Power Company, of Sao Paulo, Brazil, has just awarded the following important contracts through its local representative, H. P. Plummer: Fifty thousand feet of weatherproof cable, to be supplied by the John A. Roebling's Sons Company, of New York; 6,000 Brookfield insulators, to be furnished by the Morris Electric Company, of New York, and 7,000 insulators, to be forwarded through Knowles & Company, of Boston. The insulators mentioned in the latter contract will be manufactured by the Imperial Insulator Company, of New York. They are intended for the transmission line, and will be made to bear an especially high tension. The contracts just given out by the Sao Paulo Company, also include a variety of minor orders for electrical equipment and supplies. The larger contracts, combined with the smaller ones, show an aggregate value of over $100,000.

The Service Building of the Pan-American Exposition.

The Service Building, of the Pan-American Exposition, to be held at Buffalo, N. Y., from May 1 to November 1, 1901, was the first building of the exposition to be erected, and is used by the corps of officials and employees having direct charge of the constructive work of the exposition.

The building, which is situated on the west side of the grounds, is 95 by 145 feet in plan. It is in the form of a hollow square, having two stories on its exterior facades, and three stories on the court side. The entrance, which is in the form of a driveway, faces the North and communicates directly with the inner court. Part way down this entrance, and from each side, extend the main corridors. That on the right leads to offices and apartments to be used for police headquarters and hospital service, including the rooms for the use of the Commandant of Police, police station, the Chief of the Fire Department, medical waiting-room, drug supplies, offices for a surgeon and his assistants, and an operating-room. The hospital has a *porto-cochere* entrance for ambulance and emergency purposes.

The other portions of the first floor are taken up by a large room for the officers and clerks who have charge of admissions and collections, and the auditing of accounts; these rooms are fitted with fireproof vaults.

The working offices of the Director of Works, with his private office and stenographer's room, offices for the landscape architect, the Superintendent of the Building Construction, Purchasing Agent, Chief Engineer, Mechanical and Electrical Engineer, and accommodations for the officers having charge of transportation and installation, exhibits and concessions, are arranged to carry on the business of these departments.

On the second floor is the large draughting-room used by the force of architectural draughtsmen. This department has separate offices and draughting-rooms, with a large vault for valuable drawings. On this floor are the sleeping apartments of the Director of Works and the chiefs of the various bureaus, comprising the Department of Works. Here also are numerous apartments for such of the employees as the nature of their duties requires to be continuously at the exposition grounds. A kitchen and dining-room, apartments for the janitor and hospital nurses, and several guest chambers are provided on this floor.

The top floor of the building has additional apartments, a large blue-printing-room for the use of the architects and engineers departments, and the operating-room for the official photographer of the exposition.

The building has a cellar. Frame construction has been used throughout. The studs are covered on the inside with composition board and sheathed on the outside with hemlock planks, which are covered with cement plaster, the final finish having the appearance of stucco.

The ornamental work, including the flag standards, finials, festoons, etc., are of staff. The roof is covered with Spanish tile of iron. The building is in its architecture a free adaptation of the Spanish Renaissance, such as is shown in old Californian and Mexican missions and churches. This style was followed as closely as the requirements and exigencies of arrangement for light and space necessary in a first-class working office allowed.

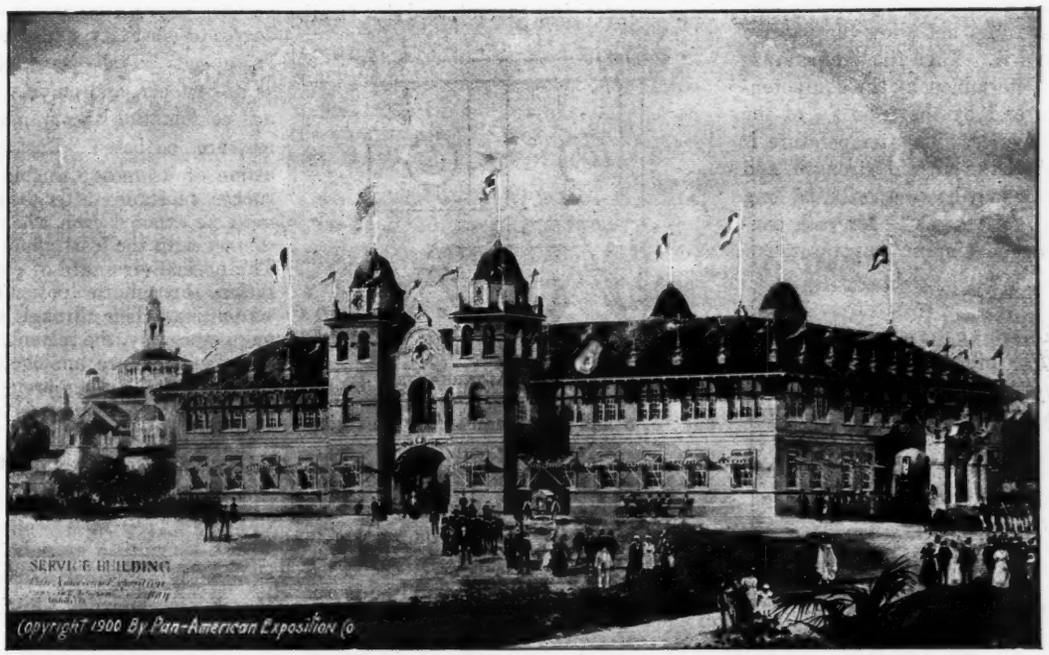
The building was erected ready for occupancy in 32 working days.

PROGRESS OF THE WORK ON THE EXPOSITION GROUNDS TO JANUARY 20, 1900.

Work was begun on the site September 26. Since that date the land has been cleared of fences, 2,400 small poplar trees, 1,200 willow bushes and 700 assorted shrubs have been planted about the border of the grounds. A boundary fence has been built eight feet high and 12,000 feet long. A nursery has been prepared and several thousand trees and shrubs have been placed therein. Seventy-five large trees have been transplanted from points in the site to avenues on the border of the grounds. Some 10,000 cubic yards of top soil have been scraped, piled, mixed and turned over. Four thousand yards of excavation have been removed from the East Lake; two green-houses, 20 by 30 by 10 feet, with propagating houses adjoining, have been built, and a number of cold frames have been set out.

The grounds have been cross-sectioned; buildings, canals and roads have been staked out, and 13,000 feet of sewer have been constructed. Plans for fire mains and domestic water supply have been completed. A route for the intramural railway has been surveyed, and from 4,000 to 5,000 feet of the canal which encircles the grounds have been excavated.

Plans have been completed for the foundations of the Agricultural Building, and complete plans for Machinery and Transportation, one of the large buildings, 350 by 500 feet. Bids for all the main buildings will be invited at an early date, and even before Spring of this year, much progress in the constructive work will be made.



THE SERVICE BUILDING OF THE PAN-AMERICAN EXPOSITION.

SCIENCE BREVITIES

Heated Conductors—The question as to what temperature is generated in an electrically-heated conductor is of great theoretical and practical interest. F. Kohlrausch investigates the condition of stationary temperature attained in such a conductor, says an abstract in the London *Electrician*. The temperature attained would be infinite if no heat were lost by radiation or conduction, and if the conductivity were not impaired by heating, since the temperature would rise steadily with the continuation of the current. The author supposes the case of a conductor whose ends are kept at constant potential and constant temperature, and whose surface does not allow the passage of heat across it. Then the temperature is perfectly determined by the equipotential surfaces and by the ratio λ/κ of the two conductivities. The temperature is independent of the current strength, and the conductor may be composite, as long as the ratio λ/κ is the same for each constituent. The maximum temperature is

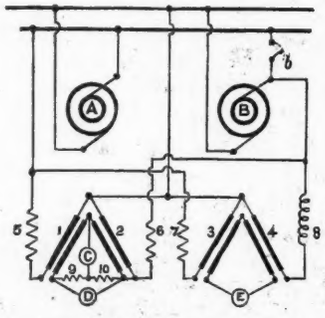
$$\theta_{max} = \frac{1}{8}\left[\frac{E^2}{\lambda/\kappa}\right]$$

if E, λ, and κ are expressed in a uniform system. The highest temperatures are furnished by the group of pure metals in which λ/κ is smallest. As it happens, the ratio is pretty much the same in all of them, and is equally influenced by change of temperature.

Double Rate of Alternation—Herr J. Zenneck has devised an ingenious method of doubling the rate of alternation of an alternating current by means of a stationary transformer. He does it with the aid of two "aluminum valves," or carbon-potash-aluminum cells, which, as we know, only allow the current to pass from the aluminum to the carbon electrode, says an *Electrician* abstract. The alternating current is split into two branches, which are wound round the core of a transformer in opposite directions. Each of the branches contains an aluminum valve, but the valve is reversed in one branch with respect to the other. The effect of this is that one-half of the alternate current passes through one branch and the other through the other branch, but in an opposite direction, so that in reality two successive maximums act upon the transformer, instead of a maximum and a minimum. This, of course, amounts to a doubling of the original frequency, though the new current is no longer sinusoidal. Curves taken off the secondary coil of the transformer show such a doubling distinctly. The author has not obtained any very favorable curves that way, but his aluminum valves were imperfect, showing both leakage and distortion. He expects that, with better arrangements, perfect doubling could be obtained.

Paralleling Single-Phase Alternators—Mr. William Stansfield, writing in our London namesake, suggests the following method for connecting single-phase alternators in parallel, and determining quickly whether the incoming engine is running too fast or too slow.

Referring to the sketch, A represents the alternator or alternators already on the busbars; B represents the incoming alternator; 1, 2, 3 and 4 are small transformers, 1, 2 and 3 preferably taking a large magnetizing current, and 4 a small



PARALLELING ALTERNATORS.

one; 5, 6 and 7 are non-inductive resistances; 8 is a choking coil; 9 and 10 are non-inductive resistances; C, D and E are incandescent lamps, and *b* a switch.

It would probably be advantageous to have resistances in series with lamps D and E, so that C, D and E could be lamps of equal voltage. The lamps should light up in the orders C, D, E or E, D, C, according to whether the incoming alternator is running too fast or too slow. It might be advantageous to replace 1 and 3 by one transformer, and perhaps wind all the batch on one set of cores.

Transformer 4 and choking coil 8 should be arranged to get as large a lag as possible, and perhaps condensers, taking the place of resistances 5, 6 and 7, would improve the apparatus.

Devulcanizing Rubber—Mr. J. B. Hohn contributes some interesting notes on india-rubber manufacturing in *Kuhlow's Review*. The author points out that a number of the mechanical processes for working vulcanized rubber, although successful to a certain degree, do not remove any appreciable portion of the sulphur. If, however, vulcanized caoutchouc is dissolved in benzine or some other solvent in which the solubility of sulphur and caoutchouc is different, the separation out of the sulphur can be effected. If the solvent be benzine, the author states that the process of solution and reevaporation must be repeated four or five times. After each repetition the caoutchouc becomes more and more soluble and becomes gradually devulcanized. This is a strong point against there being a chemical combination between the caoutchouc and sulphur, and this assumption is strengthened by the behavior of unvulcanized caoutchouc. In treating the latter simply mixed with sulphur, but unvulcanized, in the same manner the sulphur mechanically mixed with it will separate as though it had been vulcanized, except that this occurs more rapidly, and after one repetition of the above operation. Caoutchouc recovered by any process will have lost some degree of elasticity, and it especially loses its capacity to take up sulphur as readily as raw rubber, and on this point a chemical combination theory must, in a great measure, be based. But to this modification of its most valuable property any rubber substance after being so treated must be exposed even when brought into contact with the least amount of sulphur. The normal structure of caoutchouc even suffers through the powerful mechanical action as well as through the heat, and, more especially, the solvents used. These circumstances are analogous to the fact that caoutchouc, when brought into a fluid or soft state by strong heating, becomes absolutely useless.

Magnetic Properties of the Elements—The interesting work done by S. Meyer in endeavoring to find a general law of atomic magnetism must be regarded only as a rough preliminary survey, says one of Mr. E. E. Fournier d'Albe's abstracts. The main difficulty lies in the fact that the same metal, in two states of different valencies, may be diamagnetic in one state and paramagnetic in the other. J. Konigsberger proves that cuprous compounds are diamagnetic while cupric compounds are paramagnetic. He also considers it as definitely proved that a compound formed of two diamagnetic substances may be itself paramagnetic, and instances the case of cuprous sulphide, selenide and phosphide. As far as a connection between atomic magnetism and atomic volume can be traced, it appears that there is a definite and important connection which requires unravelling. But as regards this supposed connection, it is contradicted, or rather complicated, by the anomalous position of tin. The author regards the magnetic susceptibility of water as an open question even now, and thus throws a doubt on all data obtained from aqueous solutions. The mechanical treatment of wire-drawing produces a well-marked effect upon the magnetic susceptibility in certain directions.

ELECTRIC RAILWAYS

Cleveland, Ohio, will soon be the centre of the greatest electrical suburban railway system in the world.

The National Conduit and Cable Company, of New York, has filed a mechanic's lien for about $150,000 upon the property of the Third Avenue Railroad Company, of New York, for amounts due for cables furnished.

The stockholders of the Youngstown, Ohio, Park and Falls Electric Railway at the annual meeting elected Samuel C. Grier, president; Joseph Hastings, vice-president; C. W. Dahlinger, secretary and treasurer; R. T. Ivory, general manager.

The Borough Council, of Mount Pleasant, Pa., has granted the Connellsville & Uniontown Electric Railway Company a right of way through the borough. The company pays $2,000 for the privilege and promises to have the line in operation within two months.

At a meeting of the stockholders of the Brooklyn Heights Railroad Company, the lease of the Nassau Electric Railroad Company, heretofore made by the directors of the company, was confirmed.

The old Nassau system is now operated by the Rapid Transit Company under a lease for one year, the lessees paying the fixed charges of the Nassau and $150,000. The present lease is about to expire, and it is now proposed to renew the lease, in accordance with an option given to the Rapid Transit Company at the time the lease was ratified.

Charters for two prospective trolley lines in Allegheny, Pa., have been granted at Harrisburg, both in the name of the same officers, with T. M. Latimer, president, and H. B. Haffner, A. E. Manchester, D. A. Wilbert and A. C. Latimer as directors. The first is called the Evergreen Street Railway Company, with a capital of $12,000. The name of the second is the Nunnery Hill Street Railway Company, capital, $24,000.

The Plainfield, N. J., Street Railway Company, which is controlled by Chandler Riker and Colonel Hine, of Newark, has in contemplation a short line by trolley from Plainfield to the seashore. It will cut off a long distance that now is necessary *via* Elizabethport, in order to reach Asbury Park. Hundreds of Plainfield people go to Asbury Park every season, and more would go there and to other points along the shore if the distance could be shortened.

Three million dollars have been subscribed toward the construction of the electric railroad from Camden to Atlantic City, and it is said the laying of the tracks will soon commence. The enterprise may involve the expenditure of $15,000,000. The line from Somers' Point to Pleasantville and Atlantic City has been absorbed by the new company, and it is possible that a new ferry line between Camden and Philadelphia will be a part of the system. The intention of the company is to provide direct communication with every seaside resort on the New Jersey coast. Capitalists of Philadelphia, New York, Washington and Baltimore are interested in the New Jersey & Seashore Electric Railroad Company, as it is called.

AUTOMOBILES

Making a case for the safety of the automobile as compared with horse-drawn vehicles, the editor of the *Wheel* declares that there were 819 carriage accidents in France last month, causing 68 deaths and 751 injuries. In the same month there were only 28 automobile accidents, with two deaths.

Mr. Arthur J. Eddy, a lawyer, is the recipient of the first license issued by the Board of Examiners, of Chicago, as an automobile operator. He received this by virtue of having passed the examination as stationary engineer and horseless carriage operator, and of having paid $3 in paper currency in advance of rival applicants.

Akron, Ohio, has an automobile patrol wagon, which was built by the city, and is said to be the first of its kind manufactured. The wagon complete weighs 5,500 pounds, and is equipped with two motors of four horse-power each. Its maximum speed is said to be 20 miles an hour. The wagon cost $2,300, and the city officials estimate that it will pay for itself in four years by the saving of feed bills and horseshoeing. It is asserted that in a test the new vehicle ran through deep mud and up and down hill easily.

Recent as was the establishment of the electric trolley car as a fairly satisfactory solution of the problems incidental to passenger transportation in semi-urban regions, its supremacy is already threatened by the newer automobile, says the New York *Times*. In several places plans have been made for a regular service of self-moving vehicles not limited by a track in choice of routes, and from Connecticut comes the announcement of a definite intention immediately to begin operations of this kind. The scheme is to run large automobiles, carrying 20 passengers, from New Britain to Hartford and from Hartford to Unionville. The capitalists interested in the matter have sent a committee to this city to examine vehicles of different makes, and they have practically decided to use steam as motive power for the line.

TELEPHONE AND TELEGRAPH

The Wisconsin Telephone Company has acquired the property of the Oshkosh Northwestern Telephone Company, and has come into undisputed possession of the whole local field.

Construction work on the all-Canadian telegraph line to Dawson commenced February 15. When the circuit is completed, about June 15, direct wire connection will be had with Quesnelle, Hazleton, Telegraph Creek, Atlin, Dawson, Takue, Arm, Tagish and Bennett.

The Chicago Telephone Company has filed with the County Recorder a certificate of increased capital stock from $5,000,000 to $15,000,000. It is said that the increase in stock was made in order to extend the system of the Chicago Telephone Company and form a stronger opposition to rival lines.

At the annual meeting of the Chesapeake & Potomac Telephone Company, held February 23, 1900, the following named gentlemen were elected directors: Jeremiah M. Wilson, Arthur G. Fuller, John E. Hudson, Charles J. Bell, Horace S. Cummings, Henry A. Willard, C. Jay French, John H. Cahill and Joseph P. Davis.

According to the statement for the calendar year 1899, just issued, the Erie Telegraph and Telephone Company now has 115,000 telephone subscribers in 2,300 cities and towns, and 250,000 miles of wire, of which 80,000 miles are used in the long-distance service. It owns 58 pieces of real estate in 36 cities, valued at $1,379,363.64.

An interesting feature in telephone matters last week was the rise in stock of the Erie Company of from eight to nine points. There were various rumors concerning it, one to the effect that the Western Union Telegraph Company was going to enter the telephone field and had secured control of the Erie system. This is denied by parties who should know, but the decline in American Bell stock is pointed to by others as substantiating the rumor. It is safe to say that there will be some important developments in telephone and telegraph circles at an early date, and there will be a lining up of the forces now controlled by the American Bell Telephone Company, the Western Union Telegraph Company and the Postal Telegraph-Cable Company, the three leading companies in this important branch of the electrical industry.

ECONOMIC ASPECTS OF MUNICIPAL FRANCHISES.

BY ALLEN RIPLEY FOOTE.

The following is an abstract of a lecture recently delivered by Mr. Foote at the Ohio State University.

A municipality should be granted full power to render any local service, social or industrial, that the welfare of its inhabitants may require. The only limitations on this broad grant of power should be found in the general laws and public policy of the state requiring that every municipal service shall be rendered by the most efficient agent, in the best manner known to the art, and that no person shall be taxed for the purpose of supplying a private user with an industrial service.

A social service is a service rendered for the general welfare for which no specific charge to the user is made based on the service used. Such services include education, recreation, sanitary measures for the protection of health and police measures for the protection of life and property.

The entire costs of social services are paid by taxation. Such taxes are the compensation paid to society by property owners for the consent of society to the private ownership of property, and the protection of owners in the exercise of such rights. Such services are the compensation given by society to owners for the value of the property taken from them by taxation. All property so taken is socialized and devoted to social uses. Every addition to the list of social services broadens the sphere of social and correspondingly curtail the domain of private property.

An industrial service is a service rendered for the general welfare for which a specific charge to the user is made, based on the service used. Such services include the private uses of water, lighting and transportation.

The entire costs of industrial services should be paid by users in proportion to the use of the service enjoyed by each. The payment made is the compensation given by the user for the service rendered to him. The service is the compensation given to the user for the amount collected from him. Payments for such services are a part of the cost of living or of conducting business. When public service industries are owned and operated by the people all profits derived are socialized and by their amount decrease the private ownership of property. When they are owned and operated by a private corporation, profits derived belong to private owners. Private users exchange property for service with private owners. By this process no property is socialized, no deduction is made from the aggregate of private property.

A social and industrial service may be rendered by the same undertaking, such as water for fire protection, and for family use, or gas and electricity for street lighting and for the lighting of business places and residences. It is not difficult to distinguish a social from an industrial service, nor to see clearly, when both classes of service are rendered by the same undertaking, that taxpayers as a class should pay the full value of the social service, and users as a class should pay the full value of the industrial service, regardless of conditions of ownership and operation. Neither is it difficult to understand why the price to all users should be identical for all services rendered under like conditions. It will also be accepted as a sound business proposition that the true standard for service efficiency is the best service at the lowest price. Such a service at such a price will clearly best serve the interests of users and taxpayers. To enable the people to secure such service at such a price is the purpose of municipal existence.

A municipal franchise is the municipal right, granted by a state, to render social and industrial services. Possession of the right creates the duty of a municipality to devise ways and means for satisfying the collective needs of its inhabitants. This duty is co-extensive with municipal limits. It is co-existent with municipal life.

For whatever a municipality may undertake, its franchise is exclusive. A municipality can not be compelled to permit, nor will it permit, competition with itself. It includes the entire municipal limits. A municipality can not be compelled to permit, nor will it permit, a division of the service it undertakes to render. It is free from municipal taxation. A municipality can gain nothing by assessing a tax upon its own property or upon its income. It is perpetual. The state places no time limit in municipal charters. By reason of the character of its franchise a municipality is endowed with every legal economic condition that has power to induce efficiency in ownership and operation.

Since a municipality exists for the purpose of securing the best social and industrial services at the lowest prices for the satisfaction of the collective needs of its inhabitants, it is its duty to render every such service by direct ownership and operation or by contract. The decisive considerations in determining by which agent, public or private ownership and operation, any given service shall be rendered, must be whether or not it is wholly or most largely social or industrial in character; and if industrial, whether or not public or private administration will prove most economical for users and taxpayers. Services that are wholly social or most largely social should, as a general proposition, be rendered by municipal ownership and operation.

To provide efficient agents for the rendering of industrial public services the state should, by general law, provide for the incorporation of public service corporations, to be owned by private capital and operated by private management, and authorize municipalities to contract with them or with existing corporations. The law and the contract should specify that the accounts of such corporations, for the purpose of determining the true and entire costs of the service rendered, shall be public accounts, kept by a system identical with the system prescribed by the state for the accounts of municipalities owning and operating similar industries; that the investment account used as a basis of calculation shall be certified by a state auditor to be bonafide; that prices to users shall be the true cost of service plus a divisible profit equal to twice the rate of interest paid on its bonded debt by the municipality in which the service is rendered; that the corporation may adopt a system of profit sharing with its employees; and that all profit in excess of the legally limited divisible profit shall be divided equally between the municipality and the corporation. A municipal contract with a corporation for the rendering of any industrial service should include a lease of the municipal franchise, reserving the right to the municipality to determine the prices to be charged for the service during stated periods, not less than five nor to exceed thirty years, and at the termination of each such period to exercise an option either to pay to the corporation the amount of its investment account, and thereafter own and operate the industry on public account, or to fix prices to be charged for services rendered, and continue the contract for another period.

Such a contract will preserve unimpaired economic franchise conditions granted by the state to the municipality, and will induce the highest obtainable degree of efficiency in the administration of the industry, every benefit of which will go directly to the user. If this is not done, the degree in which efficiency is impaired by an impairment of franchise conditions will cause a direct loss to users through an unavoidable increased cost. When price is based on cost, the lower the cost can be made the lower the price will be.

The popular conception of a monopoly is that it is a thing of evil that must not be permitted to exist. When people are wiser they will know that all the evils they have feared or have suffered in the administration of public service industries have been the offspring of unregulated monopolistic undertakings. It is not within human power to devise a more efficient organization for rendering an industrial public service than a correctly regulated monopoly. By devising a correct system of state regulation and making it applicable to all identical features of publicly and privately owned and operated public service industries, every intelligent objection to making such industries municipal monopolies, regardless of ownership, will be completely removed. Such a system will establish a basis for comparisons that will induce intense competition for greater efficiency between all municipalities and public service corporations within a state, and between public and private ownership, from which users and taxpayers can not fail to derive the greatest obtainable benefit.

No municipality possesses social capital that it can use for the purpose of acquiring the ownership and operation of public service industry. Mention is sometimes made, with truth, of the great value of municipal assets. But these assets are not convertible; therefore they are not

available for other purposes. A municipality can not sell its school houses to get funds to invest in street railroads. Municipal ownership is held in check by the entire lack of municipal capital, and by the acknowledged inefficiency of municipal governments. To overcome these obstacles, the advocates of municipal ownership are working on two lines—one for removing all restrictions on municipal indebtedness, when based on revenue-producing undertakings; the other for improving the form and administration of municipal governments. With all efforts for improving municipal governments every honest, intelligent, loyal citizen must be in most hearty sympathy. But a very grave danger, which may be easily avoided, however, lurks in recent proposals regarding municipal indebtedness. If a debt incurred on account of the revenue-producing industry is to be excluded from statements of debt made to determine the debt-incurring capacity of a municipality, it must be made certain that such a debt can not become under any circumstances a charge upon taxpayers' property. The purpose of the debt limit is to protect taxpayers in their right to own property. This purpose will be nullified by any measure that makes it possible for a municipality to in any way incur a debt in excess of the legal limit, that may, under any circumstances, become a charge upon taxpayers' property. In the case of public service industries it is wholly unnecessary for taxpayers to take any such risk.

A state law governing the taxing power of municipalities and their power to incur debt should provide, in the case of revenue-producing industries:

1. That all debt incurred in behalf of such industries shall be secured only by mortgage on the property and franchise involved.

2. That when a municipal plant and franchise is under mortgage, there shall be included in the costs of ownership and operation an annual provision for a sinking fund sufficient to pay the debt at maturity, and that the price charged for the service shall be sufficient fully to pay annually the true and entire cost of service so calculated. By the terms of these provisions the debt incurred for the municipal ownership and operation of public service industries will be a users', not a taxpayers' debt. The enterprise will be undertaken to supply users with service at cost, and to save for them the profits being made by private corporations. A user has no moral, he should have no legal, right to obtain an industrial service at less than its cost. If he does, taxpayers' property, to the amount of the deficit thus caused, must be confiscated for his benefit.

3. That no industrial service rendered by a municipality shall be sold at a price less than its true and entire cost.

A few years' operation under the terms proposed will socialize sufficient capital to displace the capital borrowed from private owners. Municipal ownership and operation will then reach its ideal conditions, when, free from all charges on account of the disturbing element of private capital, service can be rendered to users at the cost of ownership and operation, exclusive of capital charges.

If the proposals regarding public service industries contained in the adopted report of the National Municipal League, and in the tentative report of the Ohio Municipal Code Commission, are enacted in law, in any state, that law will open a new era of wild speculation, to be followed by inevitable disaster as far-reaching and paralyzing as the era of railroad building aided by public bonds. Students of this subject need only to study the history of municipal township, county and state bonds voted in aid of railroads to learn the fate that awaits municipalities when states delegate to them the power to issue bonds, without limit, for the purchase or construction of works to carry on public service industries. The proposal to exclude such bonds from the debt limit removes the only barrier in existing law upon their issue. When municipalities have this power it will become the business of promotors to realize upon the enormous amount of misinformation that has been taught to the people regarding the profits of corporations, by inducing municipalities to buy existing works, or to construct new ones, under the delusion that they can thereby cut prices for services in two, and benefit themselves by grasping the profits now earned by corporations.

When it is considered how ready a majority of people are to benefit themselves at some other person's expense, especially when it can be done indirectly under the forms of law, it will be seen how readily authority to issue such bonds can be obtained from a constituency in which a majority of voters think they pay no taxes. If by voting for an issue of bonds which they think they can not be taxed to pay they believe they can secure a reduction in the price of the services for which they know they do pay, they can be depended upon to vote for bonds at every opportunity.

If the power contemplated is granted to municipalities it will injure taxpayers far more than it will injure corporations. Corporations can protect themselves by exchanging their property for municipal bonds, which the taxpayer will be called upon to pay. But taxpayers will be absolutely without protection. Such a power will seriously impair the right to own property in every municipality in which it is exercised. Instead of gaining benefits from their public improvements so undertaken, they will find the liability to burdensome taxation an incubus upon enterprise that will stifle all growth and reduce the value of all property within its influence. If any property owner doubts this statement he can not serve his own interests better than by studying the relations of his property to existing municipal taxation and then to calculate, if he can, how much his taxes will be increased when the municipality has exercised this power, as it may when given opportunity.

The Ohio Municipal Code Commission proposes to give municipalities power to own and operate the following public service industries. In Section 2073 a municipal garbage plant. In Section 2137 municipal gas works, water works and lighting works. In Section 2165 to "levy and assess, upon the general tax list, an assessment on all taxable real and personal property in the corporation, for the payment of the cost and repairs of the following improvements, including the cost of the necessary real estate therefor, water works, gas works and public lighting works." In Sections 2277, 2278, 2279 and 2280, to buy water works by an issue of bonds at rate of interest not to exceed six per cent per annum and to run not more than 20 years, and to "levy a tax of sufficient amount to pay the interest of such bonds, and to provide for the redemption of the same." In Sections 2283, 2384, 2385, 2386, to cities of 50,000 inhabitants and over to buy existing street railways, to issue six per cent, 20-year bonds therefor, and to "levy a tax of sufficient amount to pay the interest on such bonds, and to provide for the redemption of the same." In Sections 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, to cities of 50,000 inhabitants and over to construct and operate street railways, issue six per cent, 20-year bonds therefor, and the Council shall annually, after such street railway shall have been put into operation, if necessary, levy and assess such a tax as, together with the receipts from the street railway and other moneys applicable to the purpose, shall be sufficient to provide for said interest and sinking fund, the same to be assessed and levied upon the entire taxable property of the corporation." In Sections 2401, 2402, 2403, 2404, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, to buy or construct a telephone system, to issue six per cent, 20-year bonds therefor, and, "if necessary, levy and assess such a tax, as, together with the receipts from the telephone service and other moneys applicable to the purpose, shall be sufficient to provide for said interest and a sinking fund, the same to be assessed and levied upon the entire taxable property of the corporation." In Section 2652, in addition to taxes specified in Section 2651, by sub-Section 26, "the council in each city and village may levy taxes, annually, for water works, gas plants, electric lighting plants, telephone plants, street railways or any of them, owned, operated and controlled by any municipal corporation, when the proceeds derived from the operation of such works, plant or plants or such street railway are found to be insufficient to pay the expenses of operating and conducting the same, respectively, and the council of such municipal corporation may levy the taxes on each dollar valuation of all the taxable property listed for taxation in the corporation, both real and personal, to pay the amount found to be due on the operating expenses thereof after applying them to the proceeds of such works or plant or plants and street railways." In Section 2683, "in determining the city's power to incur indebtedness there shall not be included the following classes of indebtedness: Bonds issued for the purpose of

erecting or purchasing water works and supplying water to any city and the inhabitants thereof, for the purpose of erecting or purchasing gas works, or electric light works, for supplying light to the city and its inhabitants, or for the purpose of constructing, erecting or providing any public service which shall permanently produce a revenue to the city, owned and operated by the city."

Here is a complete destruction of every barrier in existing law, placed there as the result of a bitter experience for the protection of property owners from the evils of excessive municipal indebtedness and taxation.

The theory upon which the Code Commission bases its proposed grant of powers is that public service industries are producers of revenue and therefore will provide for themselves. Would it not be wise in putting this theory into practice to provide that they shall do so, instead of destroying all inducement to hold them to a correct test by providing that taxpayers shall make good all failures to pay operating expenses, interest on bonds and provision for sinking fund? With a constituency taught to expect great reductions in prices for services as a result of municipal ownership and operation, in which there is from 10 to 50 voters who think they pay no taxes for every one who knows he does, how long will a city council be able to protect taxpayers by holding prices sufficiently high to pay all costs of ownership and operation and capital charges? Add to the deficit-producing power of selling these services at less than cost inefficient management by a committee of council and the prospect for taxpayers is truly appalling.

When a city has issued its bonds for the purpose of a garbage plant, water works, gas works, electric lighting works, street car and telephone systems, and is operating all of these industries with no check on the prices it shall charge for the services rendered, but with special power to levy taxes to make good all deficiencies to cover cost of operation, interest and sinking fund provisions, can any one tell what property in that city will be worth? Clear-headed business men can regard with complacency the proposals on this subject contained in the reports of the National Municipal League and the Ohio Municipal Code Commission only because they do not understand them.

A danger that can not well be overestimated is found in the growing discontent with existing conditions. A mistake made now by adopting the proposals under consideration will do the municipalities of this country an injury from which they can not recover in a generation. We have heard much about the crime of voting away the rights of unborn generations through granting long-term franchises to corporations. What about the crime of placing a mortgage on unborn generations to satisfy a theoretical demand for the municipal ownership and operation of all public service industries? The vitality of the crime, in either case, is in the fact that such procedure is absolutely unnecessary to the attainment of the desired result, which is the best service at the lowest practicable price.

The lowest practicable price under municipal ownership and operation is one that will provide for all costs of ownership and operation and for a sinking fund to redeem the bonds issued on account of the industry. If a municipality having an absolute and perpetual monopoly, and the power to fix prices for the services it may render at any rate it pleases, can not secure a sufficient revenue from the industry fully to pay all cost of ownership and operation and to provide for the redemption of the bonds issued for the purchase or construction of the works, it has no business to be in the business.

Municipalities should be prohibited from placing a mortgage upon taxpayers' property, and from raising any money whatever by taxation for the purchase or construction and operation of any public service industry. They should be authorized to secure funds for such industries only by mortgaging the property and franchise, and a pledge of revenue sufficient fully to pay all costs of ownership and operation and to provide for the redemption of the bonds issued in behalf of the industry.

With no possibility of competition, and absolute power to so fix prices that they will produce the revenue required, there is no necessary reason why any municipality can not secure all the funds it may require for public service purposes on these conditions and protect the property from foreclosure. If it can not do this, that fact, or the fear of it, is sufficient reason why a municipality should not be given power to involve taxpayers in an inevitable disaster by mortgaging their property for such a purpose.

The lowest practicable price under private ownership and operation is one that will provide for all costs of ownership and operation and for a reasonable profit on the investment. A correct standard for determining reasonable profit may be established by providing that the corporation may earn a dividend at a rate per cent upon its investment equal to twice the rate per cent paid on its bonded debt by the municipality in which the service is rendered, and that all the divisible earnings in excess of this rate shall be divided equally between the corporation and the municipality. If the theory is correct that private management is more efficient than political management, the price of service rendered by private corporations, when limited by cost, plus a reasonable profit, as indicated, will be as low, if not lower, than price of service rendered by municipalities, when fixed at cost, plus a provision for a sinking fund.

Every realizable advantage of municipal ownership and operation can be gained by granting power to municipalities to lease their franchises to private corporations under contracts that provide:

1. That all accounts necessary for determining costs of service shall be public accounts, prescribed and audited by the state.

2. That the investment account used in calculating costs and profits shall be bona fide.

3. That all statements of costs of ownership and operation shall include interest on the investment at the rate paid on its bonded debt by the municipality in which the industry is located; a sufficient provision for insurance against loss by accidents of any kind; the amount of municipal, county and state taxes paid; an ample provision for insurance against the impairment of the investment by depreciation; and the true and entire costs of all materials used, and salaries and wages paid, and an accurate statement of all miscellaneous expenses.

4. That the profit of the corporation over and above costs calculated as specified shall be determined and limited by twice the rate of interest paid on its bonded debt by the municipality.

5. That the corporation may adopt a system of profit-sharing with its employees, in which case the same dividend shall be paid on wages earned as on capital invested.

6. That all the divisible surplus profit shall be divided equally between the corporation and the municipality.

7. That prices to be charged for services rendered shall be determined for periods of not less than five nor more than 30 years, and shall be fixed at rates calculated to produce sufficient revenue fully to pay all costs of ownership and operation, plus the legal profit.

8. That at the expiration of every period for which prices to be charged for services have been fixed, the municipality shall have the option of paying to the corporation the full amount of its investment and thereupon taking possession of the property and thereafter operating it as a municipal plant, or of determining prices for another period and continuing its contract with the owning and operating corporation.

The initial investment to be used as a basis for calculation in such a contract should be determined by an investigation by the municipality, or, if mutually agreed between the corporation and the municipality, by process under the law of eminent domain or by arbitration.

If a municipality can contract with public service corporations on these terms it will be in a better position financially and will secure better and cheaper services for users than it can by owning and operating the industry. Such a contract is the best defense taxpayers can devise for their own protection against burdensome municipal debts and taxation. Such a settlement of municipal franchise problems will bring order out of chaos, and will enable American municipalities to move forward on lines of true progress.

Such a contract can be made sufficiently flexible to adjust itself to all changing conditions and to secure for resident users every advantage that may grow out of the increasing importance of their city as an industrial centre. It may even be made the means of causing non-resident users to contribute to a decreased price

for resident users or for some desired municipal object. To illustrate: If the rule for determining price should fix a street car fare at four cents, the reduction should be given to resident users by selling five tickets for 20 cents, but the cash fare should be retained at five cents. The extra cent collected on cash fares will come almost entirely from non-resident users. By its collection the price to resident users can be decreased still more for the next period of price adjustment, or it may be provided that one cent out of every cash fare shall be paid to the municipality for some special purpose, such as the erection of a city hall, public library, or hospital.

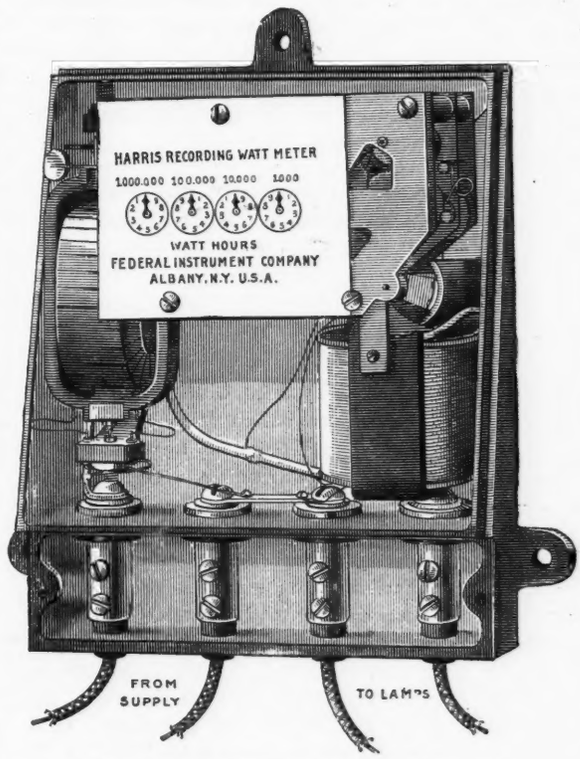
It is urged against this proposal that workingmen would not buy tickets. There is no reason why they should not. Twenty cents is as easily paid for five tickets as five cents can be paid for each ride. It only represents the fare to and from work for two days. The workingman who is not sufficiently thrifty to profit by buying five tickets at a time is not sufficiently thrifty to profit by having a cash fare sold to him for four cents. His need is not to have unthriftiness made easy for him, but to have thrift forced upon him. Every time he buys tickets, gives a quarter and gets five tickets and a nickel in return, he will have placed in his hand physical evidence of the benefit the contract is to him. If he has sufficient pluck to save that nickel and deposit it in an account that will earn him interest his journey toward comfort will be well begun.

Such a contract will dispel the fallacies of attempting to secure good and cheap service by granting rights to competing corporations. The people will know that the secret of low prices is found in keeping down investment and expenses of administration, not in duplicating plants or administrative machinery. They will know that no corporation can live and do business at a loss; that the cost of a divided business must be more than that of a consolidated business covering all of the service and that no corporation can work for a less profit than that allowed by the contract; therefore, that there can not be a lower price established by competition than the price voluntarily agreed to in making the contract.

Such a contract will aid the carrying out of any municipal or state public policy regarding the taxation of public service corporations. All taxes, in whatever form assessed and for whatever purpose collected, will be included in statements of costs made to determine price. This will take from corporations any reason for opposing any tax that may be assessed upon them.

Such a contract guarantees efficient administration. By insuring the safety of capital and a reasonable profit for its management, it renders it possible for any municipality to obtain all the capital that can be profitably employed in its public service industries, without taking one dollar from taxpayers, or adding one dollar to the municipal debt, and on terms that will be certain to secure for users the best possible service at the lowest practicable price. More than this can not be accomplished by any conceivable method of managing municipal franchises.

Those who have made investments under conditions as they found them, and have thereby contributed to the development and welfare of a municipality, are justly entitled to a preference in making the contract described. No municipality should be guilty of constructing a competing plant when it can contract on the terms proposed, nor of granting franchises for extensions to existing or other corporations. The contract contemplated covers all required extensions, as it is based on a lease of the municipal franchise, which necessarily includes the entire city. It is to the interest of the city, as a prospective purchaser of the property, to prevent any unnecessary duplication of plants and administrative machinery and complication of every kind by refusing to grant franchises for the purpose of inducing competition with, or of dividing the business of, existing corporations.



A New Form of Integrating and Recording Watt-Hour Meter.

Security for investments and opportunity to earn a reasonable profit and certainty of just treatment are the conditions that will induce abundant investments, secure the most efficient management, relieve municipalities from burdensome debts, protect taxpayers from excessive taxation and secure for users the best services at the lowest practicable prices.

Such a solution of municipal franchise problems is greatly to be desired by all municipalities and their inhabitants.

Such a solution can be obtained if all of the people it will benefit will unite in demanding that power be given to municipalities to make contracts as proposed.

A New Type of Wattmeter.

The new type of recording watt-hour meter which is illustrated herewith is of peculiarly simple construction and is intended to record on dials in the usual way watt-hours when connected with direct-current sources of electrical supply. The method of operation of the instrument is as follows: The current upon entering the meter passes through a dynamometer, entirely free from iron; the deflections of the dynamometer cause an arm having a transfer wheel at its extreme end to swing between two rollers; the lower one of which has a raised portion and the actuating mechanism being controlled by an accurately adjusted balance, causes an electromagnet to be energized, which records the indications of the dynamometer, the roller having the raised portion revolving and transferring the motion of the surface in contact with the transfer wheel to the upper or integrating roller, which, being connected through a train of wheels to the pointers on the dial, records directly in watt-hours the power consumed. No constant or multiplier is used.

The device for recording being entirely separate and distinct from the dynamometer, the work of driving the integrating mechanism is performed entirely by the electromagnet. By this construction it will be seen that frictional error in recording power consumed has been largely eliminated, the dynamometer readings merely indicating by changes in position, the changes in load.

The instrument is manufactured by the Federal Instrument Company, of Albany, N. Y., and is one of several types of electrical instruments manufactured by the same concern.

National Electric Light Association's Convention.

The Central Passenger Association has granted a special rate of a fare and one-third, on the certificate plan, from all points in its territory to Chicago and return, for delegates and friends attending the 23d convention of the National Electric Light Association, to be held in Chicago, Ill., May 22, 23 and 24 next. It is expected that the various other passenger associations will announce the same concession at an early date.

RECENT PROGRESS IN WIRELESS TELEGRAPHY.*

BY G. MARCONI.

When Ampere threw out the suggestion that the theory of a universal ether possessed of merely mechanical properties might supply the means for explaining electrical facts, which view was upheld by Joseph Henry and Faraday, the veil of mystery which had enveloped electricity began to lift. When Maxwell published, in 1864, his splendid dynamical theory of the electromagnetic field, and worked out mathematically the theory of ether waves, and Hertz had proved experimentally the correctness of Maxwell's hypothesis, we obtained, if I may use the words of Professor Fleming, "the greatest insight into the hidden mechanisms of Nature which has yet been made by the intellect of man." We can not pay too high a tribute to the genius of Heinrich Hertz, who worked patiently and persistently in a new field of experimental physics, and made what has been called the greatest discovery in electrical science in the latter half of the nineteenth century. I can not forbear saying one word as to the eminent electrician who was placed in his last home as recently as Saturday last, for it is manifest that several years ago Professor Hughes was on the verge of a great discovery, and if he had persevered in his experiments it seems probable that his name would have been as closely connected with wireless telegraphy as it is with so many branches of electrical work in which he has gained so much renown and such great distinction.

The experimental proof by Hertz 13 years ago of the identity of light and electricity, and the knowledge of how to produce and how to detect these ether waves, the existence of which had been so far unknown, made possible true wireless telegraphy. I think I may be justified in saying that for several years the full importance of the discovery of Hertz was realized but by very few, and for this reason the early development of its practical application was slow. All of you know that the idea of communicating intelligence without visible means of connection is almost as old as mankind. Wireless telegraphy by means of Hertzian waves is, however, very young. I hope that if I pass over the story of the growth of this new art, as I have watched it, or do not attempt to prove the questions of priority, no one will take it for granted that nothing is to be said on these subjects, or that all that *has* been said is entirely correct.

The time allowed for this discourse is too short to permit me to recount all the steps that have led up to the practical applications of to-day. I believe it will probably interest you more to hear of the problems which have lately been solved, and the very interesting developments which have taken place during the last few months.

Mr. Marconi then gave a short explanatory description of his system and the apparatus used, for the benefit of those of his audience who were unacquainted with the principles of wireless telegraphy by means of Hertzian waves. In describing the transmitter, he stated that, should it be necessary to direct a beam of rays in a given direction, the vertical wire and earth connection are omitted and the spheres placed in the focal line of a metal cylindrical parabolic reflector.

The form of coherer I have adopted is shown in Fig. 1, and I find that a great element of the success of wireless telegraphy has been dependent on using such a coherer.

It had been his experience and that of other workers that the coheror as previously constructed—that is, a tube several inches long partially filled with filings enclosed by corks—was far too unreliable to fulfill its purpose. He found, however, that if specially prepared filings were confined in a very small gap (about 1 millimetre) between flat plugs of silver, the coherer, if properly constructed, became absolutely reliable. In its normal condition the resistance of a good coherer was infinite, but when influenced by electric waves the coherer instantly became a conductor, its resistance falling to 100 or 300 ohms. This conductivity was maintained until the tube was shaken or tapped.

Having finished his description of the main features of the simple form of apparatus employed until recently, Mr. Marconi described an improvement to the system of no slight importance. In it the aerial, or vertical, wire and the earth wire at the receiving station are not connected directly to the coherer, but to the primary of a small induction coil or transformer, the secondary of which is connected to the ends of the coherer, one of the connections passing through a condenser. The object of this transformer is to increase the electro-motive force of the induced oscillations at the terminals of the coherer, and therefore causes it to break down with a weaker oscillation, and so be affected at a much greater distance than would be possible if it were connected directly to the vertical conductor. I had often noticed, during my early experiments, that a long thin wire at the receiving station would give very good results, while a shorter and thicker wire was not so advantageous. I thought that the reason of this was that the breaking down of the insulation of the tube was more dependent on the electro-motive force of the inducer oscillation than on its quantity. In order to apply the necessary electro-motive force to the tube at great distances, we increase the electro-motive force of the oscillations induced in the wire or strip at the expense of the quantity.

I had formerly ascertained that the distance over which it is possible to signal with a given amount of energy varies approximately with the square of the height of the vertical wire and with the square root of the capacity of a plate, drum, or other form of capacity area which may be placed at the top of the wires. The law governing the relation of height and distance has already been proved correct up to a distance of 85 miles. Many months ago it was found possible to communicate from the North Haven Poole to Alum Bay (Isle of Wight), with a height of 75 feet, the distance being 18 miles. Later on, two installations with vertical wires of double that length—*i. e.*, 150 feet—were erected at a distance of 85 miles apart, and signals were easily obtained between them. According to a rigorous application of the law, 72 miles ought to have been obtained instead of 85, but, as I have previously stated, the law has been proved only to be approximately correct, the tendency being always on what I might call the right side; thus, we obtain a greater distance than the application of the law would lead us to believe. There is a remarkable circumstance to be noted in the case of the 85 miles signaling. At the Alum Bay station the mast is on the cliff, and there is no curvature of the earth intervening between the two stations—that is to say, a straight line between the base of the Haven and Alum Bay stations would clear the surface of the sea. But in the case of the 85 miles the two stations were located on the sea level, and between them exists a hill of water, owing to the earth's curvature, amounting to over 1,000 feet. If these waves traveled only in straight lines, or the effect was noticeable only across open space in a direct line, the signals would not have been received except with a vertical wire 1,000 feet high at both stations.

Leaving this interesting point for the present, I would like to say a few more

* Abstract by the *Electrician* of a discourse delivered at the Royal Institution, February 2.

words about the induction coil. It will probably interest you to know that it is not every induction coil that will work, but this transformer must be a very remarkably wound induction coil. While carrying out some experiments nearly three years ago, at Salisbury, Captain Kennedy, R. E., and I tried numerous forms of induction coils wound in the ordinary way—that is, with a great number of turns of wire on the secondary circuit—with the object of increasing, if possible, the distance or range of transmission; but in every case we observed a very marked decrease in the distance obtainable with a given amount of energy and height. Similar results were obtained some months later, I am informed, in experiments carried out by the general post office engineers, at Dover.

In all our above mentioned experiments the coils used were those in which the primary consisted of a smaller or larger number of turns of comparatively thick wire, and the secondary of several layers of thinner wire. I believe I am right in saying that hundreds of these coils were tried, the result always being that by their employment the possible distance of signaling was considerably diminished instead of being increased. We eventually found an entirely new form of induction coil that would work satisfactorily, and that began to increase the distance of signaling. This consisted of a coil, the primary of which was wound with fine wire contrary to usual custom, and the secondary with still finer wire. The peculiarity of this new coil or transformer was that, if the secondary circuit happened to be wound in more than one layer, no results were obtainable. This was considered to be a disadvantage, as it is impossible (owing to the thinness of the wire on the primary) to wind a secondary of much greater length over or under it, or of a much greater number of turns; and this is necessary in order to obtain a higher ratio of transformation between the primary and secondary than 1:1.

The next step in advance was a coil in which the number of turns of the secondary is increased at the ends of the coil, the secondary forming at each end two sections of lumps. This form of coil gave much better results than the previous one.

The results given by some of these induction coils have been remarkable. During the naval manœuvres I had an opportunity of testing how much they increased the range of signaling with a given amount of energy and height. When working between the cruisers Juno and Europa I ascertained that when the induction coil was omitted from the receiver the limit distance obtainable was seven miles, but with an induction coil a distance of over 60 miles could be obtained with certainty. This demonstrated that the coils used at that time increased the possible distance nearly tenfold. I have now adopted these induction coils or transformers at all our permanent stations.

A number of experiments have been carried out to test how far the Wehnelt break was applicable in substitution for the ordinary make and break induction coil at the transformer station; but, although some excellent results have been obtained over a distance of 40 miles of land, the amount of current used, and the liability of the break getting fatigued or out of order, have been obstacles which have so far prevented its general adoption.

As is probably known to most of you, the system has been in practical daily operation between the East Goodwin lightship and the South Foreland lighthouse since December 24, 1898, and I have good reasons for believing that the officials of Trinity House are convinced of its great utility in connection with lightships and lighthouses. It may be interesting to you to know that, as specially arranged by the authorities of Trinity House, although we maintain a skilled assistant on the lightship, he is not allowed to work the telegraph. The work is invariably done by one of the seamen on the lightship, many of whom have been instructed in the use of the instruments by one of my assistants. On five occasions assistance has been called for by the men on board the ship and help obtained in time to avoid loss of life and property. Of these five calls for assistance, three were for vessels run ashore on the sands near the lightship, one because the lightship herself had been run into by a steamer, and one to call a boat to take off a member of the crew who was seriously ill.

In the case of a French steamer which went ashore on the Goodwins we have evidence in the Admiralty Court that, by means of one short wireless message, property to the amount of £52,518 was saved; and of this amount, I am glad to say the owners and crews of the lifeboats and tugs received £3,000. This one saving alone is probably sufficient in amount to equip all the lightships round England with wireless telegraph apparatus more than ten times over. The system has also been in constant use for the official communication between the Trinity House and the ship, and is also used daily by the men for private communication with their families, etc.

At the end of March, 1899, by arrangement with the French Government, communication was established between the South Foreland lighthouse and Wimereux, near Boulogne, over a distance of 30 miles, and various interesting tests were made between these stations and French warships. The maximum distance obtained at that time, with a height of about 100 feet on the ships, was 42 miles.

The most interesting and complete tests of the system at sea were, however, made during the British naval manœuvres. Three ships of the "B" fleet were fitted up—the flagship Alexandra and the cruisers Juno and Europa. I do not consider myself quite at liberty to describe all the various tests to which the system was put, but I believe that never before were Hertzian waves given a more difficult or responsible task. During these manœuvres I had the pleasure of being on board the Juno, my friend, Captain Jackson, R. N., who had done some very good work on the subject of wireless telegraphy before I had the pleasure of meeting him, being in command. With the Juno there was usually a small squadron of cruisers, and all orders and communications were transmitted to the Juno from the flagship, the Juno repeating them to the ships around her. This enabled evolutions to be carried out even when the flagship was out of sight. This would have been impossible by means of flags or semaphores. The wireless installations on these battleships were kept going night and day, most important manœuvres being carried out and valuable information telegraphed to the admiral when necessary.

The greatest distance at which service messages were sent was 60 nautical miles between the Europa and the Juno, and 45 miles between the Juno and the Alexandra. This was not the maximum distance actually obtained, but the distance at which, under all circumstances and conditions, the system could be relied upon for certain and regular transmission of service messages. During tests messages were obtained at no less than 74 nautical miles (85 land miles).

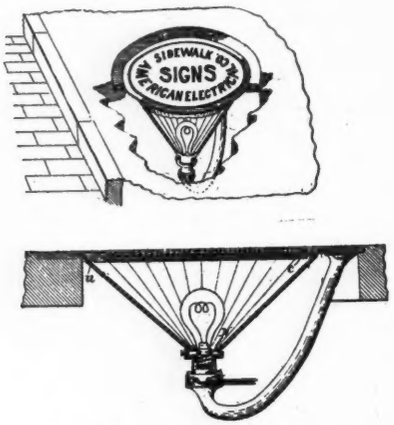
As to the opinion which naval experts have arrived at concerning this new method of communication, I need only refer to the letters published by naval officers and experts in the columns of the *Times* during and after the period of the Autumn manœuvres, and to the fact that the Admiralty are taking steps to introduce the system into general use in the navy. As you will probably remember, victory was

(*Continued on page 220.*)

An Electrical Advertising Device.

The use of electrical means for attracting the public eye is growing rapidly. A few years ago the first electric sign blazed out, and now in such cities as New York and Chicago they actually furnish a considerable part of the illumination of certain thoroughfares.

The electrically illuminated sign here illustrated is the invention of Mr. John E. Lloyd, of Cleveland, Ohio. It is intended to be sunk flush in the pavement and so



A New Electrical Advertising Device.

attract the attention of persons walking over it at night. The construction of the apparatus is so fully shown in the illustration, which is taken from the patent specification, as to require no further explanation.

Telephone Rates.

The question of the proper adjustment of telephone rates is one that has occupied a vast degree of attention in late years. This has been especially the case since the independent telephone movement was inaugurated and since the attempt has been made in many communities to regulate telephone charges by legislation or in some other way. It has been forgotten in these cases that the true regulation of any charge for service is found in the workings of the law supplying the man, with modifications brought to it by local conditions.

In New York city an interesting experiment has been tried with great success by the New York Telephone Company, and the system of charging for telephone service has been based upon its cost as a message rate. This may be defined as a tariff built upon the use which the subscriber makes of his telephone. If a non-subscriber wishes to use the telephone he goes to a public pay-station where he has a conversation of five minutes for ten cents. A subscriber coming in at the lowest rate is permitted to have 600 calls a year for $60 a year, or at the rate of ten cents per message. For incoming messages to his station no charge is made. This sum is the lowest price asked for telephone service and considering that it puts the subscriber in communication with about 40,000 others, it is a low charge. Depending on the use made of the telephone, contracts are scaled from this figure up to a rate of $240 a year for unlimited use. If any subscriber at any of the other rates uses his telephone more than the number of times called for in his contract during the year he is charged *pro rata* in excess of his contract obligations.

The effect of this change of rates and scaling of rates according to use has been very noticeable. It has led to a wide extension of the use of the telephone in private residences and has increased the number of stations enormously. For example, in five years there has been a gain of over 27,000 stations on Manhattan Island, the gains in the year 1899 being 10,500 stations. The present rate of increase is a little over 1,000 stations a month, which is entirely unapproached elsewhere in the world.

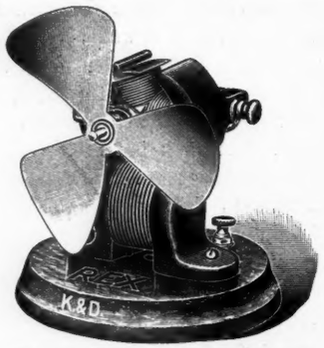


Fig. 1.—Small Battery Motors.

The system of the New York Telephone Company is not only the largest but probably the best in the world. The common battery system, which is being installed under the patents of Mr. J. J. Carty, is a vast improvement over other methods of telephone central station working, as it does not require the subscriber to turn a crank or ring a bell and makes no unnecessary noise or trouble in its operation. The simple act of lifting the receiver from the hook communicates with the central office without the necessity for any bell signal.

Contrasting the simple and satisfactory operation of this system with the condition of things obtaining in cities where two telephone systems are in competition, it will be seen that its cost, even when considered without reference to the large number of subscribers connected, is very reasonable. In cities in which competing systems are in operation it is necessary for the subscriber to have both services. This condition of things has already been found unsatisfactory in many places.

So general has been the adoption of the scaled system of telephone charges that out of 40,000 subscribers connected to the New York exchange, only 2,200 retain the old flat-rate basis of payment for their telephone contracts.

Small Battery Motors.

A small motor, that is not exactly a toy and which, while interesting to the small boy, is also useful for working small advertising devices and other machinery requiring the smallest possible amount of effort, is illustrated in Fig. 1 herewith. This little machine weighs about one pound and operates satisfactorily on a single charge cell of dry battery.

Fig. 2 shows a motor of larger size containing a drum armature of six cells and develops an appreciable fraction of one horse-power when supplied with current from a good battery of two or three cells. Both these machines are manufactured by Messrs. Kendrick & Davis, of Lebanon, N. H., who make also a large number of other types of small battery motors and accessories. These motors are also wound to run in series with a 16-candle-power incandescent lamp when it is not convenient to use a primary battery with them.

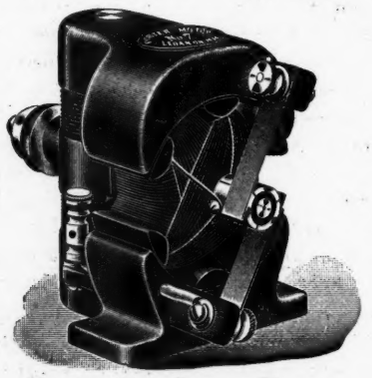


Fig. 2.—Small Battery Motors.

Progressive Siberia.

Almost all the towns in Siberia are having arc lights for street use and incandescent lights for houses, and the larger proportion of the people in Siberia have never seen gas, which they regard as an illuminant of a past age.

Schiff, Jordan & Company, New York city, the well-known importers of carbons and electrical specialties, have already booked a considerable amount of business in their new specialty, Austrian porcelain electrical goods, such as those illustrated in last week's number of the Electrical Review.

Northern Electrical Manufacturing Company's Fan Motors.

The illustrations herewith showing some of the types of motors for fan work

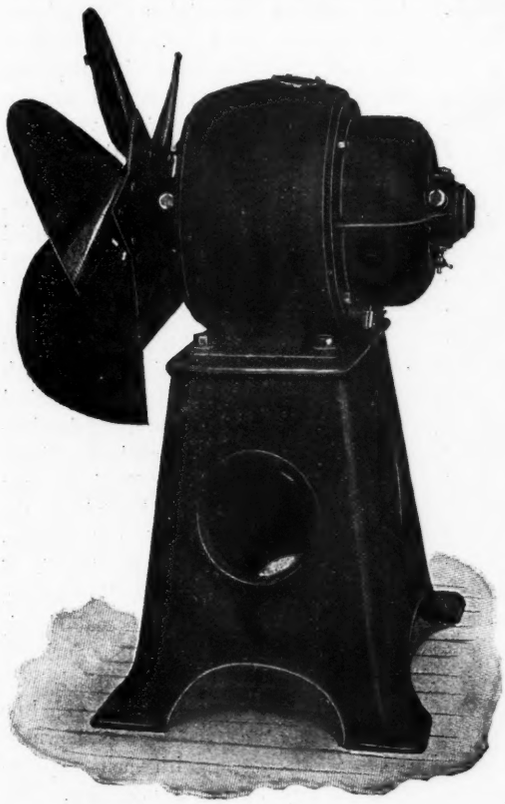


FIG. 2.—ENCLOSED MOTOR OPERATING A 24 INCH FAN.

built by the Northern Electrical Manufacturing Company, of Madison, Wis., are almost self-explanatory. Fig. 1 shows a multipolar enclosed type of motor direct-coupled to a Barney ventilating fan for exhaust ventilation.

It will be noted that the construction is exceedingly light and compact, and that dust and moisture are completely excluded from the motor by its casing.

In common with other types of motors, this machine may be converted into an open type by merely opening the case.

Fig. 2 shows an enclosed motor operating a 24-inch ventilating fan, the whole being mounted on cast iron pedestal. It may be readily removed from this and set in any position.

Fig. 3 shows a direct-coupled exhaust fan outfit in which an open type of motor is shown.

The characteristic of all these motors is careful workmanship and high-class materials. No cast-iron is used in them, only "magnet steel" being employed, and bar winding is used throughout. The motors are built for rough and ready hard service, and are made in many sizes and for various voltages.

Very satisfactory results are being obtained in Washington in the collection of mail from street letter boxes by means of automobiles. On one of the longest routes in the city the automobile covered the distance in 32 minutes, including 27 stops. The regular collector's time for this trip is 1 hour and 45 minutes, and with a horse-drawn vehicle 1 hour and 20 minutes.

American Institute of Electrical Engineers.

The 140th meeting of the Institute will be held at 12 West Thirty-first street, New York city, on the evening of February 28. A note on "A Farad-Meter" will be presented by Dr. M. I. Pupin. A paper will also be presented by Edward C. Boynton, entitled "Notes on Electric Traction under Steam Railway Conditions." Mr. Boynton's paper will be printed in the January issue of the *Transactions* and will be distributed at the meeting.

Applications have been received from the following candidates for associate membership, which will be acted upon by the council at its meeting March 28, 1900: Fred A. Fish, Columbus, Ohio; A. N. Shaw, Brooklyn, N. Y.; Harry B. Marsh, Indianapolis, Ind.; Carl F. Fog, Lynn, Mass.; S. W. Rushmore, Jersey City, N. J.; J. M. Morehead, Chicago, Ill.; M. H. Offinger, Buffalo, N. Y.; Chas. C. Stutz, New York city; J. W. Esteline, Lafayette, Ind.; Max D. Baron, New York city; F. O. Blackwell, Schenectady, N. Y.; I. J. Macomber, Chicago, Ill.; J. D. Mortimer, Berkeley, Cal.; A. C. Babson, Berkeley, Cal.

A meeting of the executive committee will be held at 26 Cortlandt street, at 3 P. M., February 28.

The electric light plant at the Ludington, Wells & VanSchaick Company's mill, at Menominee, Mich., was wrecked a few days ago by the bursting of a fly-wheel. Pieces of iron were hurled in all directions, but no one was hurt. Two big holes were broken in the brick wall and the roof of the power house was torn off.

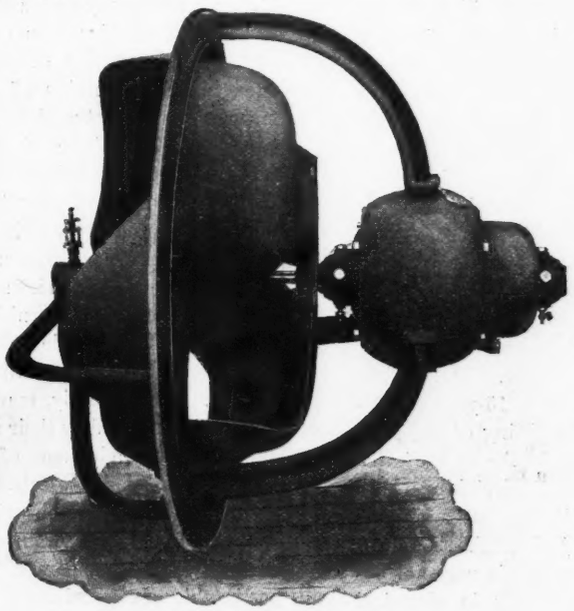


FIG. 1.—ENCLOSED NORTHERN MOTOR COUPLED TO FAN.

FIG. 3.—DIRECT-COUPLED EXHAUST FAN OUTFIT.

EXPORT NOTES

Referring to the operation of the war and future trade in South Africa, the *Railway Herald,* London, says that engineering firms, mostly American, are sending out representatives to take the measurements of all bridges and other works which have been destroyed, so as to obtain orders for renewals.

Hopkins, Gardom & Tetley, engineers, of Calle 25 de Mayo No. 130, Buenos Ayres, Argentina, have obtained a contract for the completion of the Transandine Railway. This road will be on the Argentina side of the Andes about 20 miles and on the Chilian side about 22 miles in length, most of which route is through the mountain. The work includes several large tunnels and considerable machinery and supplies will be required at an early date.

New iron companies are still being formed in Russia. According to Vice-Consul Monoghan, at Chemnitz, Germany, a stock company has just been formed in Irkutsk, Russia, with a capital of 1,000,000 rubles ($515,000), to develop the iron fields lying in the neighborhood. It is intended to produce cast and refined iron. A company has also been organized in St. Petersburg, with a capital of 6,000,000 rubles ($3,090,000),to work iron mines in Siberia. A German mining engineer has been put at the head of the St. Petersburg company.

La Societa Impianto Electrico di Cerano a Trecate is the style of a new company which was recently formed in Milan, Italy, with a capital of $50,000 to undertake general electrical constructions. Water power is so plentiful in some sections of Italy that the field for water-wheels can not be overestimated. The demand from Italy for manufactured iron material continues firm. The last mail brought inquiries for considerable iron pipe and also for railroad iron to merchants in New York city. To Genoa the shipments of cotton are assuming considerable importance, and from that port many orders for manufactured products are pending.

Requisitions from Paris, France, for bids on what is claimed will make up an electrical power plant worth upwards of $60,000 have been received by an electrical manufacturing firm in New York, with the request to cable price and earliest possible time of delivery. This is only one instance in many which have recently shown how impatient French contractors are for material which they can not get at home. In all branches of the engineering trade the same conditions exist. Upwards of $15,000 worth of electrical material are being shipped weekly to Havre, and information received says that as the exposition buildings near completion so as to permit the installation of electric apparatus the demand will increase for all sorts of electrical goods.

Inquiries from Cuba (Havana and the south side principally) for railway equipment and material would seem to indicate that some of the roads contemplate extensive repairs at an early date. Within the past few days, $15,000 worth of rails were sent to Havana, and if prices were lower for railroad iron, it is claimed by merchants who purchase for roads on the island, many contracts would have been closed before this late day. Trade conditions generally with Cuba continue fairly active. The fact that not many orders for manufactured goods are at present being placed is only due to the large stock which importers received throughout January. An extraordinary business is, however, being done with the best outlook that the island has ever had in its history. If the Cuban Central Railroad is ever carried to completion it will be one of the greatest incentives for the development of the vast agricultural resources of the island. During the first week of February, the total shipments from this port to Cuba reached to nearly $300,000.

Further reports from Madrid show that in industrial undertakings this will be a banner year in Spain. The establishment of central electric lighting stations in many interior towns seems to be a particular feature to which the attention of American engineering firms is called through their London and Berlin branches for the reason that in those centres they are turning their attention towards Spain as a promising field. The water power of the river Turia is to be utilized at an early date, establishing an electric lighting station at Villa Marchante. In Pieddrahita (Avila Province) a 15-year concession for the electric lighting of the town is to be given towards the end of this month. In all these undertakings both German and English concerns are figuring extensively, and through the latter considerable American-made material has been furnished. Not only in electrical undertakings, but in other branches as well is Spain making headway fast. Coal and iron mines are being worked to greater extent this year, and railroad projects are not lacking. Every week there are more or less shipments directly from New York to Barcelona, but they could be increased to ten times their amount in less than six months in the opinion of merchants in a position to know. The cooperation of manufacturers is required, however, in order to carry out successfully the exportation of a vast variety of manufactured goods which would find a market in that extensive field, says the New York *Commercial Bulletin.* To Gijon there have been some substantial shipments from here lately, such as machinery, tools, windmills and electrical material.

Information on the proposed Manchester-Liverpool Electric Railway, in which so many of the large American electrical engineering concerns are awaiting developments, is given by the Manchester *Guardian,* which says that the Parliamentary estimate for its construction places the total cost of the undertaking at £1,750,000. The estimates give the length of the railway from Dansgate, Manchester, to its termination at the Bluecoat Hospital, Liverpool, at 34 miles, four furlongs and two chains. The railroad will throughout be constructed as a double line in accordance with the system known as the monorail system, with such modifications as may be found necessary. The principal expenditures of interest to manufacturers in this country are: Stations, £67,600; estimate cost per mile, £18,000; in viaducts. £173,000, and contingencies, £117,940. The scheme is proposed to be carried out by a company with a share capital of £2,000,000 and a loan capital of £666,000. A deputation of gentlemen interested in the promotion of the proposed railway waited last week on the Parliamentary Sub-Committee of the Manchester City Council to submit the plans of their undertaking so far as they may affect scheduled property within the city boundary. As in other large undertakings of similar nature American material and machinery have been furnished, and a great effort will be made to secure a share of the contract when the proper time arrives. Consequently, manufacturers are being kept posted by their agents in England as to the development of this and other electric railroad projects. As has been frequently stated, the electrical work contemplated in Great Britain this year is so extensive that home manufacturers will not be able to cope with the demand. For this reason considerable attention is being given by our manufacturers to that field with the expectation that a very large share of the work will be given on this side.

A Portable Electric Power Installation.

In many varieties of work it is a great desideratum to be able to take the tool to the work rather than to take the work to the tool. This is especially true in such classes of industry as ship-building, etc.,

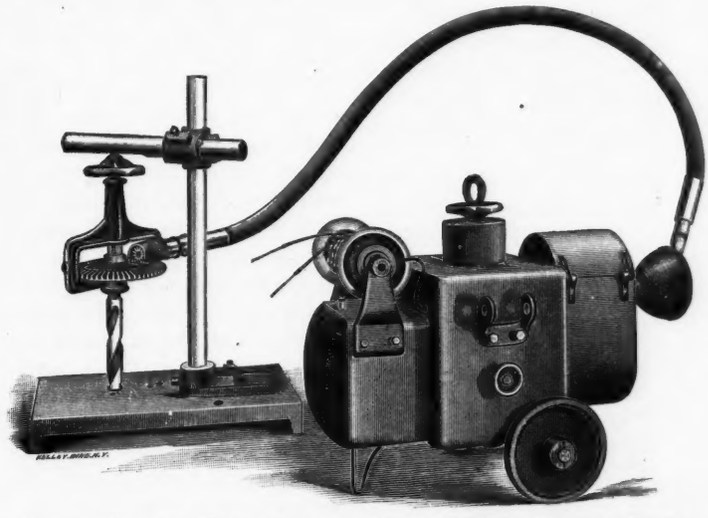


FIG. 1.—PORTABLE MOTOR OPERATING DRILL THROUGH FLEXIBLE SHAFT.

where the pieces handled are very heavy, or where conditions prevent their being removed in order to be worked upon by machine tools. The illustrations represent clearly an ingenious method for using drills, milling cutters, reamers, etc., operated by electric motor through the agency of a flexible shaft. The motor itself, as the illustrations clearly show, is mounted on a truck and furnished with a reel for wire so that it may be moved about over a considerable area surrounding its point of attachment to the power mains. Connected with this motor is a flexible shaft which permits the individual tool, such as the drill shown in the illustration, to be moved about over a smaller radius without disturbing the position of the motor proper.

The most ingenious feature of the device, however, is the method adopted for securing an exceedingly accurate range of speed revolution in the motor. Everyone is aware of the great wastefulness of regulating the speed of a motor by means of a resistance in series with its armature, and of the fact that when the field current is varied for this purpose, the field frame must be made considerably heavier and more expensive in order to provide sufficient commutating field at high speeds. The multispeed motors, here illustrated, are manufactured by the Stow Manufacturing Company, of Binghamton, N. Y., under patents granted to F. A. Johnson, covering the principle of varying the field magnetism at the centre of the pole-piece to vary the speed without sensibly altering the commutating field at the pole tips. The method by which this is accomplished is illustrated in the "transparent" cut. The pole-pieces are made hollow, the cavities being filled with soft iron plungers which are movable by means of the screw and hand-wheel at the top of the motor. It will be readily seen that when the plunger is withdrawn, the total magnetism through the armature is diminished in proportion to the movement of the plunger, but that the paths for magnetism leading to the pole corners are still unobstructed and sufficient commutating field is maintained to prevent sparking. These motors are made with a variation of about 50 per cent and are said to run sparklessly at all speeds and loads up to 50 per cent over-load. With this system of regulation all speeds between the highest and lowest can be obtained, instead of the five or 10 definite speeds obtainable by the ordinary rheostat, so that the speed is capable of the most delicate adjustments. The armatures of these motors are of the toothed-drum type, built up of disks of electric steel and rigidly keyed to the shaft. The slots and conductors are carefully insulated, largely with mica, and the finished armature, as is the field coil, is treated with a special insulating compound which is thoroughly baked, thus rendering it firm and impervious to moisture. The commutator is built of hard-drawn copper segments of ample size and insulated with mica. The field-coil is form-wound, and being circular is very perfectly insulated. The bronze bearings are large and automatically self-oiling. All of the material entering into the construction of these motors is of high grade, and they are built entirely by skilled workmen. Their speeds are very low and they have unusually powerful torque. They are so designed that the frame completely encloses the working parts of the motor and this, in connection with the cover, which can be easily removed to give access to the commutator and brushes, thoroughly protects the motor from rough usage and foreign materials, and makes it practically dust and waterproof.

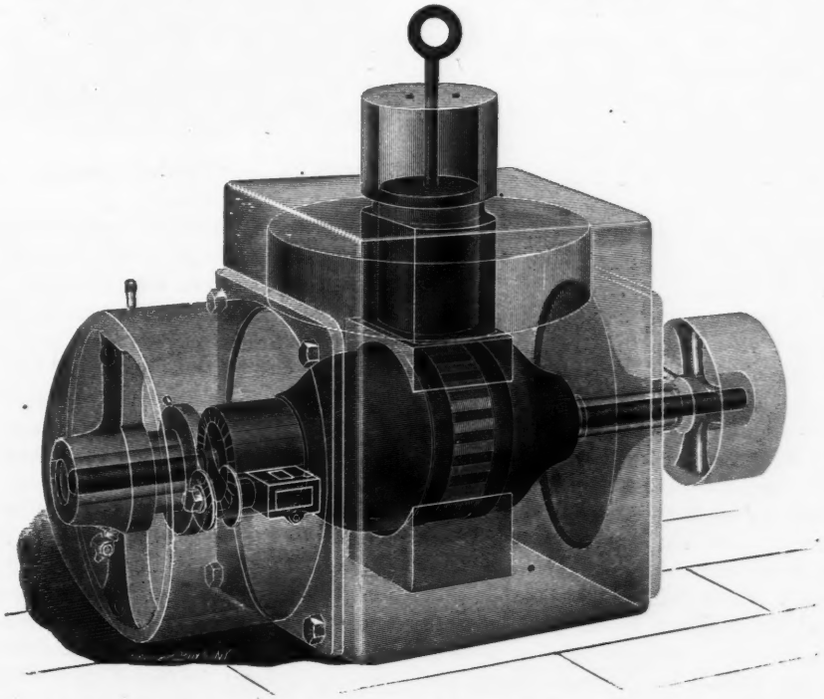


FIG. 2.—"TRANSPARENT" VIEW OF MOTOR SHOWING SPEED REGULATION METHOD.

RECENT PROGRESS IN WIRELESS TELEGRAPHY.

(Concluded from page 215.)

gained by the "B" fleet; and perhaps I may venture to suggest that the facility which Admiral Sir Compton Domville had of using the wireless telegraph in all weathers, both by day and night, contributed to the success of his operations. Commander Statham, R. N., has published a very concise description of the results obtained in the *Army and Navy Illustrated.*

The most important results from a technical point of view obtained during the manœuvres were the proof of the great increase of distance obtainable by employing the transformer in the receiver as described in the foregoing, and also that the curvature of the earth which intervened, however great the distance attained, was apparently no obstacle to the transmission. The maximum height of the top of the wire attached to the instruments above the water did not on any occasion exceed 170 feet, but it would have been geometrically necessary to have had masts 700 feet high on each ship in order that a straight line between their tops should clear the curved surface of the sea when the ships were 60 nautical miles apart. This shows that the Hertzian waves had either to go over or round the dome of water 530 feet higher than the tops of the masts, or to pass through it, which latter course I believe would be impossible.

Some time after the naval manœuvres, with a view of showing the feasibility of communicating over considerable distances on land, it was decided to erect two stations, one at Chelmsford and another at Harwich, the distance between them being 40 miles. These installations have been working regularly since last September, and my experiments and improvements are continually being carried out at Chelmsford, Harwich, Alum Bay and North Haven Poole. In the month of September last, during the meetings of the British Association in Dover, and of the Association Francaise pour l'Avancement de Science in Bolougne, messages were exchanged with ease between Wimereux, near Bolougne, and Dover Town Hall, a distance of 30 miles.

An interesting point was that it was demonstrated that the great masses of the Castle rock and South Foreland cliffs lying between the Town Hall, Dover, and the lighthouse did not in the least degree interfere with the transmission of signals. This result was, however, by no means new. It only confirmed the results of many previous experiments, all of them showing that rock masses of very considerable size intervening between two stations do not in the least affect the freedom of communication by ether-wave telegraphy (see *Journal* of the Institution of Electrical Engineers, April, 1899, page 280).

It was during these tests that it was found possible to communicate direct from Wimereux to Harwich or Chelmsford. This result was published in a letter from Professor Fleming addressed to the *Electrician* on September 29. The

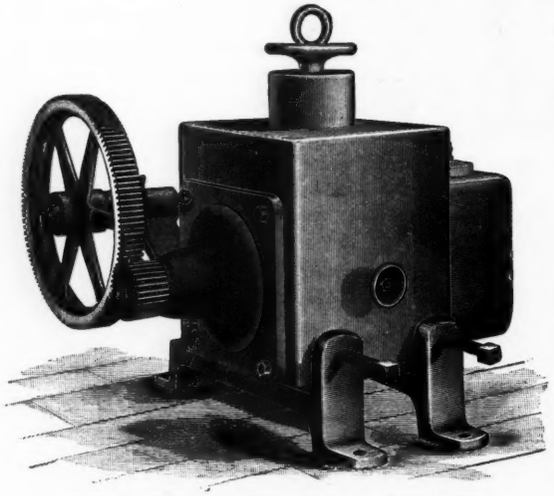


FIG. 3. STOW MULTIPLE-SPEED GEARED MOTOR.

distance from Wimereux to Harwich is approximately 85 miles, and from Wimereux to Chelmsford also 85 miles, of which 30 miles are over sea and 55 miles over land. The height of the poles at these stations was 150 feet, but if it had been necessary for a line drawn between the tops of the masts to clear the curvature of the earth, they would have had to have been over 1,000 feet high.

In America wireless telegraphy was used to report from the high seas the progress of the yachts in the international yacht race, over 4,000 words being transmitted in the space of less than five hours on several different days. Some tests were carried out for the United States navy; but, owing to insufficient apparatus, and to the fact that all the latest improvements had not been protected in the United States at that time, it was impossible to give the authorities there such a complete demonstration as was given to the British authorities during the naval manœuvres. Messages were transmitted between the battleship Massachusetts and the cruiser New York up to a distance of 36 miles.

A few days previous to my departure from America the war in South Africa broke out. Some of the officials of the American line suggested that, as a permanent installation existed at the Needles, Isle of Wight, it would be a great thing, if possible, to obtain the latest war news before our arrival on the St. Paul at Southampton. I readily consented to fit up my instruments on the St. Paul, and succeeded in calling up the Needles station at a distance of 66 nautical miles. All the important news was transmitted to the St. Paul while she was under way steaming 20 knots. The news was collected and printed in a small paper called the *Transatlantic Times,* several hours before our arrival at Southampton.

At the tardy request of the War Office, we sent out Mr. Bullock and five of our assistants to South Africa. It was the intention of the War Office that the wireless telegraph should only be used at the base and on the railways, but the officers on the spot realized that it could only be of any practical use at the front. They therefore asked Mr. Bullock whether he was willing to go to the front. As the whole of the assistants volunteered to go anywhere with Mr. Bullock, their services were accepted, and on the 11th of December they moved up to the camp at De Aar. But when they arrived at De Aar, they found that no arrangements had been made to supply poles, kites or balloons, which, as you all know, are an essential part of the apparatus, and none could be obtained on the spot. To get over the difficulty they manufactured some kites, and in this they had the hearty assistance of two officers—*viz.,* Major Baden Powell and Captain Kennedy, R. E., who have often helped me in my experiments in England. (Major Baden Powell, it will be remembered, is a brother of the gallant defender of Mafeking.)

The results which they obtained were not at first altogether satisfactory, but this is accounted for by the fact that the working was attempted without poles or proper kites, and afterwards with poles of insufficient height, while the use of the kites was very difficult, the kites being manufactured on the spot with very deficient material. The wind being so variable, it often happened that when a kite was flying at one station there was not enough wind to fly a kite at the other station with which they were attempting to communicate. It is therefore manifest that their partial failure was due to the lack of prop-

er preparation on the part of the local military authorities, and has no bearing on the practicability and utility of the system when carried out under normal conditions.

It was reported that the difficulty of getting through from one station to another was due to the iron in the hills. If this had not been cabled from South Africa it would hardly have been credible that anyone should have committed himself to such a very unscientific opinion. As a matter of fact, iron would have no greater destructive effect on these Hertzian waves than any other metal, the rays apparently getting very easily round or over such obstacles. A fleet of 30 ironclads did not affect the rays during the naval manœuvres, and during the yacht race I was able to transmit my messages with absolute success across the high buildings of New York, the upper stories of which are iron.

However, on getting the kites up, they easily communicated from De Aar to Orange River, over a distance of some 70 miles. I am glad to say that from later information received they have been able to obtain poles, which, although not quite high enough for long distances are sufficiently useful. We have also sent a number of Major Baden Powell's kites, which are the only ones I have found to be of real service. Stations have been established at Modder River, Enslin, Belmont, Orange River and De Aar, which work well and will be invaluable in case the field telegraph line connecting these positions should be cut by the enemy. It is also satisfactory to note that the military authorities have lately arranged to supply small balloons to my assistants for portable installations on service wagons.

While I admire the determination of Mr. Bullock and our assistants in their endeavor to do the very best they could with most imperfect local means, I think it only right to say that if I had been on the spot myself I should have refused to open any station until the officers had provided the means for elevating the wire, which, as you know, is essential to success.

Mr. Bullock, and another of our assistants in South Africa, has been transferred, with some of the apparatus, to Natal to join General Buller's forces, and it is likely that before the campaign is ended wireless telegraphy will have proved its utility in actual warfare. Two of our assistants bravely volunteered to take an installation through the Boer lines into Kimberley, but the military authorities did not thing fit to grant them permission as it probably involved too great a r[illegible]. What the bearing on the campaign would have been if working installations had been established in Ladysmith, Kimberley and Mafeking before they were besieged, I leave military strategists to state. I am sure you will agree with me that it is much to be regretted that the system could not be got into these towns prior to the commencement of hostilities.

I find it hard to believe that the Boers possess any workable instruments. Some instruments intended for them were seized by the authorities at Cape Town. These instruments turned out to have been manufactured in Germany. Our assistants, however, found that these instruments were not workable. I need hardly add that no apparatus has been supplied by us to any one from whom the Boers could possibly have obtained any of our instruments.

I have spoken at great length about the things which have been accomplished. I do not like to dwell upon what may or what will be done in the immediate or more distant future, but there is one thing of which I am confident—*viz.*, that the progress made this year will greatly surpass what has been accomplished during the last twelve months; and, speaking what I believe to be sober sense, I say that by means of the wireless telegraph telegrams will be as common and as much in daily use on the sea as at present on land.

American Manufactured Products in Germany.

Inquiries from Berlin, Germany, demonstrate that American manufactured products are, to a greater extent, being used in large works in that country. The Allgemeine Electricitats Gesellschaft, of Berlin, and Schuckert & Company, of Nuremberg, are asking for prices on large quantities of electrical and mechanical machinery from local concerns. In either case, if the orders are obtained by the manufacturers here they will be of unusual interest, as in both cases the concerns are large manufacturers. According to forwarders for manufacturing firms in New York city, during the last few days upwards of $10,000 worth of electrical material was sent to Hamburg from here by one concern alone. The volume of trade in hardware with Germany is unprecedented; stock orders reaching in value to more than $5,000 are of common occurrence for builders' hardware. A Chambers street agent for out-of-town manufacturers said that it has become necessary for large lock and other concerns making specialties to appoint agents at either Berlin or Hamburg for the purpose of handling the business.

ELECTRIC LIGHTING

The electric light plant at Durham, N. C., destroyed by a boiler explosion, belonged to Julius S. Carr. The loss is $15,000; the insurance, $12,000.

The Worcester, Mass., Electric Light Company has petitioned the Gas and Electric Light Commission for authority to issue $100,000 additional capital stock, the proceeds to be used in putting its wires underground and enlarging its plant.

The patronage of the electric light plant at Madison, S. D., has increased to such an extent as to require an enlargement of the plant to double its present capacity. It is estimated that the improvements will entail an expense of at least $8,000, of which amount $4,500 was provided for in the last tax levy.

The annual meeting of the Milwaukee, Wis., Electric Railway and Light Company was held recently, and John I. Beggs was elected a director in place of A. Marcus, of New York. At the annual meeting of the Milwaukee Light, Heat and Traction Company its directors, who all reside in New York, were reelected. This is the corporation which operates the lines to Racine, Waukesha and neighboring cities.

The Consolidated Electric Light Company, of Nashville, Tenn., has broken ground for a $200,000 light and power plant, which is to be a reproduction of the present plant and double its capacity. The double plant is necessitated by the increasing demands for power for street railways and cable light lines to suburban towns. The improvements will give light and power sufficient for Birmingham and suburbs for years to come.

At the annual meeting of the Hartford, Ct., Electric Light Company the following officers and directors were chosen: Officers—A. C. Dunham, president; D. N. Barney, treasurer; Curtis C. Cook, secretary. Directors—A. C. Dunham, William H. Bulkeley, W. O. Burr, Lucius F. Robinson, Atwood Collins, E. B. Bennett, Henry Roberts, W. L. Robb, D. N. Barney, E. K. Root, W. F. Henney, Ralph W. Cutler, H. P. Stearns. Robert W. Rollins was appointed general manager by the directors, who also voted to increase the capital stock to $1,050,000. The increase in the capital stock was for the purpose of paying for various permanent additions to the plant, and the new dam and power works on the Farmington River. The new stock will be allotted at par to the old stockholders at the ratio of one share for two, the increase of the stock being 50 per cent.

Electric Traction Experiments in London.

The feeling of the British technical press towards the the slowness of electrical exploitation in its own country is well shown by the following remarks from our London namesake:

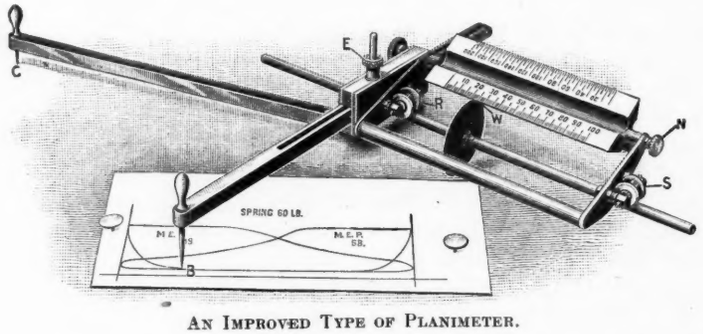
Whatever may have been the views of the shareholders of the Metropolitan Railway Company with reference to the statement of the chairman regarding the electric propulsion experiments now in operation, we confess to a feeling of dissatisfaction. We are told that certain trials have been made, but further tests are necessary because before the directors can decide upon the question. It might, however be as well to quote the chairman's remarks before making any comments; they are as follows:

In regard to the experiments in electrical traction between Earl's Court and High street, Kensington, the board felt some disappointment that those experiments had not yet been completed, and that they were therefore unable to make any definite statement in regard to the result. The shareholders, however, might rest assured that the question of the adoption of electric traction was exercising the board's very careful attention, and he might state that they had tried other experiments on a piece of line at Wembley Park, which, so far as they had gone, had given the directors and officials an amount of valuable information that would assist, materially, in solving the difficulties in the way of applying electrical traction to the working of the company's railway. They also considered that those additional experiments had been valuable in training the engineering staff at Neasden, in the use of the new tractive power.

Of course there can be little doubt that if electricity is eventually applied to working the Metropolitan Railway, it will be one of the most important applications of electricity in the world, but one must confess to a certain amount of misgiving as to what the directors are doing in the way of experiments; what are they endeavoring to arrive at and what are the experiments showing? One is almost inclined to think, judging by the chairman's remarks, that they are going into the question of electric traction *de novo,* without much reference to what has been already accomplished in the United States, in Europe, and particularly in our own country.

Even if one were to study only the electric underground railways of London there is a vast fund of information and data, much of which could be readily applied to the problems of the Metropolitan Railway. Save for the tributary lines of the latter there do not appear to be any marked differences between the requirements of the City and South London Railway and those of the Metropolitan. It may be that the advisers of the latter concern have carefully studied the various electric railway systems of the world, and that they are perfectly acquainted with what has been done with the three-phase system in Switzerland, with the multiple unit system of the Chicago line, and the numerous branch and light railways of America. We are not suggesting that the directors of the Metropolitan Railway are not justified in being cautious in a scheme that may involve a great expenditure, but on the other hand an excess of caution may result in elementary experiments, and it is in this direction that the greatest danger is to be feared. It is apparent that the directors of the Metropolitan Railway do not consider that the Earl's Court experiments are going to be conclusive enough, or they would have hardly started a fresh set of experiments at Wembley Park. We do know for a fact that whatever results may have been achieved at Wembley, the experiments have been of a most restricted nature, and that being so, it is rather difficult to comprehend that much information could be gained which "would assist, materially, in solving the difficulties in the way of applying electrical traction to the company's railway."

We have always understood that some of the special difficulties of the Metropolitan system were the underground tunnels and cross-overs, but how could the Wembley experiments help to solve these problems? There are no tunnels and no branch lines at Wembley, and, as far as we can see, the only end for experiments there would be to determine the various details of the electrical equipment according to the work to be accomplished. But all those questions have been fully worked out, and the results are available to anyone. As far as we have seen the sample system at Earl's Court, there is no departure from previous practice, but electrical engineers who are familiar with traction questions could tell exactly what such a system would accomplish without troubling to put down plant. It could hardly be urged that traffic problems were to be considered, for the line between High street, Kensington, and Earl's Court would hardly aid in solving them. Considering that the Central London Railway will shortly be available for traffic, that the Waterloo and City is a conspicuous success, and that other underground electric railways are in progress, the policy of the Metropolitan Company would appear to be a halting one. We admit there may be some difference between the Metropolitan and the other systems, and, moreover, the length of line is quite incomparable, but any problems that may arise from these causes can not be solved by small experiments at Earl's Court and Wembley. Supposing the experiments at these places are not satisfactory to the directors of the Metropolitan Company, will they then decide that electricity can not be applied to the underground railway; or will they adopt electrical working in spite of the inconclusive nature of the experiments? If they adopt such a course, they will lay themselves open to the charge of making unnecessary experiments, and if they determine not to use electrical methods they must, in accordance with the recommendation of a Parliamentary Committee, find some adequate means of ventilating the tunnels, the condition of which is daily growing worse. The position is one of some difficulty, and is not likely to be improved if a strong attitude is not adopted.



An Improved Type of Planimeter.

An Improved Planimeter.

The planimeter illustrated in the accompanying engraving is particularly intended for the measurement of steam engine indicator diagrams, though it may be used for a variety of measurements in connection with irregular curves and areas. The scale of the instrument is sextuple and a simple motion turns it so that the reading can be made directly in the unit best suited for the work in hand. The recording wheel is made of steel and has a sharp edge, and its shaft glides freely endwise beneath the rollers which practically bear the weight of the instrument and make it very nearly frictionless. As the rotation of the wheel is not registered, trifling injuries to its edge or reductions of its diameter do not affect the result. The instrument, which is known as the Willis planimeter, is made by James L. Robertson & Sons, 204 Fulton street, New York city.

INDUSTRIAL NOTES

Donnelly's steel pole climber is being controlled by J. J. Reidy, 311-321 East street, New Haven, Ct.

The Lea Manufacturing Company, Elwood, Ind., has recently printed an artistic booklet describing the "Lea" enclosed arc lamp.

The A. L. Bogart Company, 123 Liberty street, New York, are manufacturers of electric gas lighting specialties of all descriptions.

The Michigan Electric Company, "Detroit's great electrical supply house," is agent for the Bryan-Marsh "Imperial" incandescent lamps.

The Non-Polarizing Dry Battery Company, 625 Broadway, New York, has recently prepared a combination battery box for use with gas engines.

The Burnley Battery and Manufacturing Company, Painesville, Ohio, says that 200,000 boxes of the Burnley soldering paste were used during 1899.

Panel boards and other switchboard specialties are excellently illustrated in the catalogue issued by Zimdars & Hunt, 157 Fifth avenue, New York.

The Gilmore Electric Company, South Boston, Mass., reports a most successful season for the sale of lamps, rosettes and electrical specialties bearing this name.

Edwards & Company, manufacturing electricians, 144th street and Fourth avenue, New York, have been operating to the capacity of their factory during the past months.

If anybody in the electrical field using lamps and transformers is not supplied with a copy of its lamp and transformer catalogue, the Electric Appliance Company, Chicago, wants to know it.

The Norton Electrical Instrument Company, Manchester, Ct., wishes it announced that it will send a copy of its recent catalogue of electrical measuring instruments to those who request it.

India and amber mica, uncut or cut to any size, is carried in stock in large quantities by A. O. Schoonmaker, 158 William street, New York. Samples and quotations on special patterns will be furnished on application.

F. N. Manross, Forestville, Ct., is the maker of the "Manross" hair springs for electrical apparatus. These springs are claimed to be non-magnetic and particularly desirable for mechanical and electrical construction.

The "Noark" fuse, made by the H. W. Johns Manufacturing Company is adapted for all voltages. This fuse has the metal parts insulated with sheet mica. It is claimed to be proof against arcing and to act both as a fuse and as an indicator.

The J. Jones & Sons Company, 64 Cortlandt street, New York, has recently issued new catalogues, individually, for the following lines of supplies: Telephones, electric light and supplies, switches and electrical specialties, and bell goods; the latter is now in press.

The American Electrical Works, Providence, R. I., has sent out a very pleasing souvenir to mark Washington's birthday. It consists of a plate engraving of the famous Stuart portrait of Mrs. Washington, having as a *remarque,* a view of the gateway at Mount Vernon.

The "Electra" carbons, for enclosed long burning arc lamps, are carried in stock in sufficient quantities by the importer, Hugo Reisinger, 11 Broadway, New York, to meet the unusually large season's demand. This well-known brand of carbons is imported into America solely by the house mentioned from the Nuenberg factories and are claimed not to vary in their high excellence of quality.

The United Electric Heating Company, Detroit, Mich., has prepared a new catalogue of electric heating apparatus. The line of apparatus made by this company has been greatly developed during the past year and now includes various styles of electrically heated laundry irons, tailors' irons, chafing dishes, heaters, soldering irons, house heaters, curling irons and many other adaptations of electrical heating.

The United States Commissioners of the Paris Exposition have chosen the enclosed arc lamps of the Western Electric Company's make, for lighting the entire American section. These lamps will be placed two in series on 220-volt circuits. They will be of special design and finished to harmonize with the posts upon which they are mounted. Each post will support a pair of lamps. The posts and railings for the different exhibits are by Chicago designers, the posts being manufactured in the United States.

A large folder which is called No. 21 of the Four Track Series, has been issued by the passenger department of the New York Central Lines. This folder bears the title "Round the World by Way of New York and Niagara Falls in Sixty to Eighty Days." It contains a large amount of information of a cosmopolitan character, and an excellent railway map of the United States, showing the railway systems in good proportion. This folder is the sequel to the address given by Mr. Daniels before the International Commercial Congress, at Philadelphia, and serves to illustrate the immense debt which the manufacturing and commercial interests of the country owe to transportation lines for the effective manner in which they have advertised the products of American soil, mines and mills to the people of every country on the globe. The map which accompanies this folder is unusually clear and distinct, and the coloring and shading are artistically treated. A copy of this folder will be sent free, postpaid, on receipt of three cents in stamps by George H. Daniels, General Passenger Agent, New York Central, Grand Central Station, New York.

Accumulator Box Lining.

Street railway companies in this country and in Europe who use the accumulator system in their cars either wholly or in part, have been for several years trying to get a suitable method of lining their battery boxes which will be both durable as well as effective, the great difficulty being to obtain a lining which will not be eaten away either by acids or heat. This has been a vexing proposition necessitating a large amount of study and experiment, and was a particularly serious matter for those companies whose lines are equipped with the "mixed system," that is, accumulators for use within city limits and trolleys for open country. Many of the methods recommended and tried yielded, when put to the test, either to the actions of the acids or were rendered useless by the generation of the heat. During recent heavy snow storms in Berlin, one of the severest tests of the efficiency of any accumulator box, all of the street railways were crippled to a greater or less extent from burning out of boxes. Among them may be mentioned the Berlin-Charlottenburg Street Railway, and also the street railway in Hannover, which companies had in use various styles of box linings for the purpose of ascertaining which was the best. After this severe test referred to above, it was found that the great majority of boxes were rendered useless, in some of them holes having been burned the size of a man's hand. It is claimed that those which proved most efficient were the P. & B. system, which remained intact, with the result that there is to be a general replacing of linings with the new method, which consists of application of P. & B. paint, "ruberine," junction box compound, and "ruberoid," on many of the lines, among which may be mentioned the Grosse Berliner Strassenbahn Gesellschaft.

The Standard Paint Company, which manufactures all of the P. & B. products, is supplying the European market from its factory at Hamburg, and the goods are said to have taken the highest rank with all electrical and street railway companies.

The Pioneer Electrical Weekly.

[*New York Times.*]

The ELECTRICAL REVIEW, which is issued from the Times Building, presents its initial number of the New Year in new type, enlarged size, and of more attractive appearance than ever. It claims to be the pioneer electrical weekly in America; from the first it has been an excellent newspaper.

ADVANCE INFORMATION

Electric Light and Power.

WILLIMANTIC, CT.—The Willimantic Gas and Electric Light Company filed a certificate of organization on February 12.

LOS ANGELES, CAL.—The United Electric, Gas and Power Company has been incorporated with a capital stock of $650,000, divided into $100 shares, all of which has been subscribed. Los Angeles will be the company's principal place of business. The directors are H. V. Carter, Frederick H. Rindge, Alfred Stedman, George I. Cochran, and J. J. Davis.

WILDWOOD, PA.—The Borough Council of Wildwood has granted the franchise for a new electric light plant. The incorporators of the new company are Henry H. Ottens, George Moffett and Dr. E. W. Fleming, of Philadelphia. The capital stock of the new company is $50,000, with a paid-in capital of $25,000. A new electric light plant will be built before next season.

WILKESBARRE, PA.—Liddon Flick, editor of the Wilkesbarre *Times*, and several Scranton capitalists, have organized the Northampton County Electric Company and Consumers' Gas Company, of Northampton County, at Easton, and will apply for a charter.

NEW YORK CITY—The River District Light, Heat and Power Company, of New York city, has been organized to do an electrical business. Capital, $50,000. Incorporators: J. Douglass, of Hudson Park; C. H. Dodge, of Riverdale; E. M. Johnson, W. H. Yale, J. J. McKelvey, all of Spuyten Duyvil.

TOM'S RIVER, N. J.—The Tom's River & Island Heights Electric Light and Power Company, of Tom's River, has been incorporated for electric lighting. Capital $20,000; incorporators: S. R. Applegate, C. A. Holmes, M. Buley, E. E. Snider, A. Brant, C. Folkinburgh, C. H. Holman, J. Imlay, A. Ernst, A. Birdsall.

WASHINGTON, IND.—The Washington Light and Water Company, of Washington, has been chartered to construct and operate water-works and electric light plant. Capital, $21,000; incorporators: R. A. Brown, A. J. Padgett, H. M. Geiger, W. F. Burke, all of Washington.

PUERTO PRINCIPE, CUBA—The Puerto Principe Electric Company has been chartered in New Jersey to furnish electric lights in Puerto Principe. Capital, $200,000; the incorporators are Israel L. Kelsey, Robert A. Belancourt, Winthrop C. Bushnell, Samuel Moorehouse, all of Jersey City.

Electric Railways.

COLUMBUS, OHIO — The Columbus, London & Springfield Railway has been incorporated by John G. Webb, John M. Good, Hart F. Fisher, Emmet Tompkins, and Fletcher S. Penfield, with a capital stock of $1,000,000. The company, besides operating a passenger and freight electric road, will have its own telegraph service, and will furnish electricity for power, light and heating to the towns along the route. It is intended to make the service equal to that of steam roads.

MOORESTOWN, PA.—The Moorestown Traction Company has been organized with $100,000 capital to build a trolley line from Merchantville to Mt. Holly *via* Moorestown.

WASHINGTON, D. C.—A bill to incorporate the Wesley Heights Railway Company of the District of Columbia was introduced in the Senate to-day by Mr. Hansbrough and referred to the Committee on the District of Columbia. M. C. Butler, John T. Arms, Thomas E. Waggaman, Dr. Henry D. Fry and John F. Waggaman and their associates are named as incorporators of the railroad company. The road is authorized to construct and operate a street railway for carrying passengers, parcels, milk truck and other freight.

LENOX, MASS.—The articles of association of the Lenox Street Railway Company have been filed. The capital stock will be $11,250. The following are to act as a board of directors until others are chosen by the corporation: Charles Lanier and F. Augustus Schermerhorn, of New York city; William D. Curtis, Edward McDonald, William Mahanna, Isaac J. Newton and Murray A. Brown, of Lenox. The proposed railway is to start at the intersection of Church and Housatonic streets and extend through Housatonic street to the Lenox railroad station, a distance of two and one-quarter miles.

Telephone and Telegraph.

DOVER, DEL.—The Delaware Valley & Lake Huntington Telephone Company has been chartered to operate between various villages in Sullivan County. Capital, $2,000. Directors: James Cornwall, Cochocton; John Bennedum, Jr., and William F. Henry, Lake Huntington.

Miscellaneous.

CAMDEN, N. J.—The Electro Chemical Light and Heat Company, of Camden, has been incorporated to deal in electrical and chemical apparatus. Capital, $1,000,000; incorporators: F. C. Dowd, J. L. Gethins, P. A. Dowd.

WILMINGTON, DEL.—The Electrical Development Company, of Wilmington, which purposes to deal in electrical and other vehicles, has been incorporated at Dover. Capital, $200,000.

NIAGARA FALLS, N. Y.—The Electric Power Land Company, of Niagara Falls, has been chartered with a capital of $1,000. Directors: Frank H. Manney, of Niagara Falls, and Irwin N. Gray and Wm. H. Ashcroft, of Binghamton.

NEW YORK CITY—The Royal Furnace Improvement Company, of New York city, with a capital of $50,000, has been incorporated. Directors: Alexander Bernheimer, Benjamin Gomprecht, Joseph Oppenheimer, Jacob Samack and Walter Wolf, of New York city.

DENVER, COLO.—The Electrical Supply and Construction Company, of Denver, with a capital of $10,000, has been incorporated with William Sayre, J. Fisher, C. W. Armstrong and D. Vance Sickman, incorporators. This company was organized to engage in the manufacture, construction, buying and selling of electrical apparatus and fixtures.

TRENTON, N. J.—The Woven Steel Hose and Cable Company, incorporated recently in Trenton, is another enterprise of John A. Roebling's Sons Company. The capital stock of the company is $100,000, of which $1,000 is paid in. It will manufacture sheathing for wire, cables and electrical conductors.

American Street Railway Association Convention.

The 19th annual meeting of the American Street Railway Association will be held at "Convention Hall," Kansas City, Mo., October 16, 17, 18 and 19, 1900.

Papers will be read on the following subjects: "Double Truck Cars: How to Equip Them to Obtain Maximum Efficiency under Varying Conditions;" "Construction, Operation and Maintenance of Roads that Operate 20 Cars or Less;" "Comparisons of the Various Systems of Electrical Distribution for Street Railways;" "Consolidation of Street Railways and Its Effect upon the Public;" "The Storeroom and Storeroom Accounting;" "Painting, Repainting and Maintenance of Car Bodies."

It is expected that there will be a large exhibition of street railway supplies. The building contains 50,000 square feet of floor space, without a post or obstruction of any kind.

Friday, October 19, has been set apart as a day for the examination of the exhibits. No session of the association will be held, so that all may have plenty of time to view the exhibits. The annual banquet will be held Friday evening, when the officers-elect will be installed. The headquarters of the association will be at the Midland Hotel.

Hotel accommodations are ample and reasonable.

The Executive Committee advise all who desire rooms to apply at once. The rooms at the "Midland" will not be assigned until March 15, and will be assigned in the order in which applications are received.

Railroad rates will, in all probability, be as before—one and one-third fare for the round trip, due notice of which will be mailed in time by the secretary, Mr. T. C. Penington.

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED FEBRUARY 20, 1900.

643,649 Apparatus for controlling electric motors; J. J. Heilman, Paris, France—Four motors arranged in series diagonally two by two, so that one of the motors on the one side of the carriage is in series with one of the motors on the other side, and adapted to equalize the strains and pressure of the current in the two series of motors when the vehicle is turning a curve.

643,666 Signal system for railways; K. W. Mansfield, South Norwalk, Ct.

643,706 Telegraphic safety device; S. R. Wright, Morton, N. Y.

643,709 Electric suburban car; M. Brillinger, Toronto, Canada.

643,722 Thermostat; Chas. E. May, Dunedin, New Zealand—A metallic wire, and means for stretching it, a movable contact-piece suspended from the wire between its ends and descending by gravity when the wire is heated, and a stationary contact-piece arranged in the downward path of the movable contact-piece

643,730 Electric switch; W. T. Pringle, Primos, Pa.

643,742 Conduit system for electric railways; L. Dion, Boston, Mass.—A closed conduit having a cover or top capable of electrical conductivity, a main conductor enclosed therein, and an auxiliary conductor superimposed on said main conductor and composed of independent disconnected sections, each of said sections being free to rise and fall and having a limited freedom to move longitudinally.

643,744 Electric heater; G. C. Hawkins, Boston, Mass.

643,758 Starting-box and controller for electric motors; F. R. Blake, Boston, Mass.—A circuit-switch for the motor, a rack-bar bearing contact-fingers which cooperate with the resistance-plates, a retarding device for said rack-bar which controls its movement in one direction, a weight for moving said rack-bar in its retarded direction, and connections whereby said rack is moved in the opposite direction by the means employed for operating said circuit-switch.

643,810 Contrivance for avoiding collisions of trains; C. Burian, Buchарest, Austria-Hungary.

643,823 Motor-actuated signal mechanism; T. B. Keeler, Rahway, N. J.

648,824 Motor-actuated signal; T. B. Keeler, Rahway, N. J.—Comprises a signal blade mounted to tilt, a motor for actuating the signal, a main signal-controlling circuit, a primary circuit through the motor and a second circuit through the motor under the control of the main signal-controlling circuit for automatically operating the motor for a predetermined period after the main controlling-circuit is broken.

643,830 Telephone-transmitter; A. Stromberg, Chicago, Ill.—A revoluble electrode, a second electrode in contact therewith and means for effecting the rotation of the revoluble electrode through the agency of sound-waves without varying the pressure between the electrodes.

643,834 Electric arc lamp; C. J. Toerring, Philadelphia, Pa.—A cap-plate having a screw-thread on its outer surface, a globe pressed air-tight against the under surface, and having a bead removed from the edge of the globe, and a screw-cap for connecting the parts and effecting a double seal.

643,840 Combined electrical and tubular organ-action; W. B. Fleming, Detroit, Mich.

643,854 Electric-motor wheel; J. T Whittlesey, Elizabeth, N. J.—A stationary axle, a collar rigidly secured thereto, annular plates secured to said collar, and converging at their peripheries and an annular armature-core concentric with, and secured to, the outer edges of said plates.

643,864 Automatic return-signaling device for telephones; Franz Burger, Fort Wayne, Ind.

643,865 Controller for electric automobiles; C. G. Burrows, Windsor, Ct.—A supporting frame, terminals held by the frame, a drum, contacts carried by the drum in position to be engaged with the terminals, a handle, a plate connected with the drum and oscillated by the handle, springs made tense by the oscillation of the plate, and lugs adapted to obstruct the forward movement of the plate until a spring has been made tense.

643,898 Dental oven; H. M. Hill, St. Louis, Mo.

643,905 Valve-operating mechanism; A. N. Locke, Salem, Mass.

643,993 Telephone-transmitter; C. E. Tucker, York, Pa.

644,029 Process of electrode position of metals; S. O. Cowper-Cowles, London, England.

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